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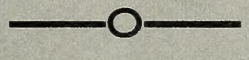

FOREST MANAGEMENT
RANGE MANAGEMENT
FOREST PRODUCTS

FOREST ECONOMICS
FOREST SURVEY
FOREST INFLUENCES

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FOREST RESEARCH

BI-MONTHLY REPORT

June 1, 1941

FOREST RESEARCH

BI-MONTHLY REPORT

June 1, 1941

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GENERAL

Allegheny

Advisory Council. At the Advisory Council meeting on May 16 and 17 in New Jersey, the importance of Eastern forests near the large industrial centers was stressed. In times of Defense the small amount of transportation necessary to bring these forest products to the markets becomes vitally important. Because of their location, cutting regulations for them are doubly vital. Discussion of regulation covered its advisability and methods of achieving it. State Foresters Taber and Besley questioned whether or not the public had a right to interfere with the operation of private land, and stated that subsidies should be used to offset the decreased returns to the owners. In rebuttal, Cope pointed out the increasing amount of regulation of all forms deemed necessary to protect the public interest, and that the question was not so much who shall decide the regulations as whether any one will decide them. From the economic standpoint, Assistant State Forester Moore of New Jersey stated that if regulation was combined with a service such as New Jersey now renders, and such as would be possible if the J.C.C. recommendations were carried out, the incomes of private owners would in most cases increase - somewhat at the present time and greatly in the future - due to obtaining a fair price for the present timber and to increasing greatly the future yield. One 40-acre tract which the Council visited illustrated Moore's contention. The owner had received a bid of $2500 for all the timber prior to the State's service on the area. Following that service the owner received about $3500 for one-half of the timber, even after paying a private forester 15% of the selling price for supervising the sale. The trip through the Pine Region of South Jersey, where the Council inspected the work of the State and Station, furnished several other examples of the need for the full J.C.C. program - including, in particular, increased public ownership, increased fire protection, and regulation of cutting. Naturally the increase in public ownership and improved fire protection would provide large work reservoirs for public labor, such as will be needed in the Post Defense era.

Branch Stations. The Standing Stone Experimental Forest in Pennsylvania is being turned over to Pennsylvania State College for management. The agreement provides that State College will cruise the timber, put in compartments, and develop a management plan and research program subject to approval by the Station Director. The Station agrees to turn over the land and equipment, and to furnish a field assistant for four months of each year to aid in the development program.

The Army has taken over 300 acres of the Beltsville Experimental Forest for an airport, and in return 463 acres of woodland are being received from the Center.

On April 20, 500 acres of the Eastern Shore Experimental Forest's 1100 acres were burned.

Cooperation. Mattoon and Simmons of the Regional office spent a week with Shirley and Hough of the Station and Supervisor Hemingway of the Allegheny National Forest reviewing past timber cutting practices on the forest to determine whether these would:

(1) Provide for a future cut within 20 years after the original.

(2) Prolong the period during which old-growth saw timber would be available for harvest until high-grade second growth is available, thereby encouraging the establishment of permanent secondary wood-using industries and guaranteeing the permanence of such plants as the Holgate Factory.

(3) Provide a reasonable reserve supply for defense needs.

The conclusion was reached that present practices were inadequate in these respects. New rules were drawn up to guide future timber marking and a training plot was established.

New Jersey has been gradually taking over tax delinquent tracts in the Pine Barrens. Since these involve a total of 350,000 acres, or so, and because the efficient use of CCC or other public labor requires long-range plans, the State has begun to prepare "management plans" for the South Jersey State Forests. These plans will give the land use of each tract (recreation, game or timber management, etc.), the improvement existing and needed (artificial lakes, roads, water holes, firebreaks, etc.), and timber management practices - past and future. The data will be summarized in maps and tables to show present conditions, future work, and returns. Naturally more or less of the information is on hand, but no standards had been set up and the information had not been recorded so that it was readily available. Hence, stands were set up and instructions for preparing the plans have been written. In these, Little assisted the State men.

Personnel. Ostrom returned to duty on June 9 from an educational leave of absence in New Haven.

Several transfers have been made to meet the reorganized flood control setup. A. S. Todd has been transferred to the Beltsville Experimental Forest; R. H. Ferguson to the Eastern Shore; G. R. Trimble to the Gale River Experimental Forest of the Northeastern Station; and A. E. Gruhl and M. E. Wolfe to the White Mountain National Forest. R. W. Pierce returned from his detail to the Coosa Survey for a new detail as hydrologist to the B.A.E. Allegheny Preliminary Examination.

Appalachian

Among the Station's May visitors were Colonel Henry S. Graves, Professor D. V. Baxter, of the University of Michigan, Assistant Chief Walter Lowdermilk and B. J. Huckenpahler of the Soil Conservation Service, and Assistant Forester E. I. Kotok and Dr. John P. Shea of the Forest Service.

Several of these men attended the Advisory Council on Human Relations held in Asheville to plan a Dixie land conference on problems in conservation.

The Station Librarian attended the meeting of the American Forestry Association held in Los Angeles May 15-17. During her trip West she visited the libraries in Region Five, San Francisco, and the libraries of the California, Pacific Northwest, and Lake States Forest Experiment Stations.

Central States

Ohio Forest Survey. Early in April, the U. S. Forest Service became the sponsor of the Ohio Forest Survey. This move has tended to draw the Survey and the Station together more closely. A memorandum of understanding to cover the sponsorship is approaching completion.

To facilitate the compilation of the volume in the county surveys, James W. Girard, Assistant Director of the Forest Survey of the Forest Service visited Ohio from May 8 to May 20, gaining first-hand contact with a portion of the State and training members of the Survey in his method of taking tree data for volume table purposes. During the period he took data on 6932 trees for board foot and cubic foot tables.

On May 17, Diller held a meeting of the District and County Supervisors at Wooster, Ohio, which was attended by two members of the Station. The main speakers were the Honorable John McSweeney of the Forest Research Act fame in 1928, and J. W. Girard.

Farm Forestry. A superseding project to continue providing financial assistance in publishing reports of the Ohio Forest Survey was submitted by Ohio in mid-April. Indiana and Iowa still desire to undertake projects to provide data on growth rates.

On May 20, Dr. E. R. Martell of Purdue School of Conservation and Forestry called a meeting of the State's Farm Forestry Committee to review progress to date. Considerable discussion centered around

the school's desire to have access to data assembled by the S.C.S. on Demonstration Areas, and to the State's desire to switch from their memorandum of understanding requiring farm owner sign-up on a complete farm plan as the price of participation in the demonstration service and advice, to a revised understanding permitting voluntary entry into the complete farm plan with no prejudice against farm woods owners who prefer not to sign them. Follow-up will be made to effect these changes.

County Agricultural Planning. A 3-day session of the Ohio State Land Use Committee at Columbus from April 30 through May 2 focussed attention on (a) the shortage of farm labor, and (b) the impact of the war and the post-war period on agriculture.

Farm labor shortages are irregular and spotty. In some Ohio localities, they are so severe that farmers are forced to let crop land lie idle and to sell dairy animals on the market. In some areas there are no shortages to date. Not only are some farm hands taken by the draft but also others are lured away by high temporary wages in industry or at arsenals. In places W.P.A.'s are being encouraged to fill the gap or at least get regular work.

The part-time labor-farmer idea received an airing and discussion indicating little rural appreciation for this arrangement. Where it now exists the farms are not adequately managed. An industrial laborer or mechanic does not make a good farmer. Land requires more than occasional attention and spasmodic partial cultivation to respond in bountiful production.

Some attention was given the present sifting out of hill people from forest land areas into industries speeding on war efforts. It was pointed out that the post-war period will again witness these same people drifting back onto marginal and submarginal lands unless action is taken to deal with it.

The opinion was stated that industry should be forced to care for its labor in times of depression rather than to dump it out into the country and hills, making agriculture the recipient pending the next boom period.

Great dissatisfaction with the A.C.P. program was expressed by the representatives from Southeastern Ohio. As framed and set up, the program is fabricated for the Corn-Belt farmer. It does not fit the hill farmer. It applies to some 13 percent of the land area in the southeastern third of the State, and totally ignores the 83 percent of land area which is permanent pasture and forest land.

Meetings. A group of Ohio foresters, including 5 station staff members, visited a number of wood utilizing industries of southern Indiana in a 3-day conference, held jointly with Indiana foresters. Evening discussions included observation of the possibilities for better forestry practices and closer utilization. R. P. A. Johnson of the F. P. Laboratory accompanied the group.

Personnel. John P. Johnston, Junior Forester, Camp F-12, Mark Twain National Forest was detailed to Columbus for a two months period beginning May 1. Johnston is in charge of the field work of the investigative studies being carried on cooperatively by the Mark Twain Forest and this station. He is to assist with the analysis of data and preparation of a report on the reproduction in forest stands in the Missouri Ozarks.

Lake States

Conference on Cutting Rules. On May 26 and 27 representatives from Region 9 and Charles L. Tebbe of the Washington Office came to the Station to confer regarding minimum cutting standards for the major forest types of the Lake States. The Station had anticipated such a demand and outlined minimum forest practice requirements in its annual report. This statement, with some moderation and translation, was accepted as a basis for the cutting rules.

Selective Cutting of Northern Hardwoods Stressed. Neetzel represented the Station at a County Agricultural Planning meeting on the Ottawa National Forest on May 8. In his talk he discussed both the economic and silvicultural angles of selective cutting in northern hardwoods, stressing in particular the advantages of frequent light cuttings.

In attendance were Gladwin Young, Regional Chief of Land Use Planning (BAE), Paul Barrett, State Representative of BAE, Forest Supervisor McKennan and others from the Ottawa Forest.

FOREST ECONOMICS

ECONOMIC - SOCIAL BENEFITS

Pacific Northwest

Work is now under way on several phases of the Grays Harbor unit study. While this project is organized under the Forest Survey, it involves the integrated efforts of nearly every division of the Station. It is a critical and comprehensive analysis of the forest situation in the Grays Harbor unit. The unit consists of Grays Harbor, Pacific, and western Jefferson Counties, and totals 2.5 million acres of land of which 2.3 million acres is forest land. This area has 48.8 billion board feet of saw timber, 20.9 billion board feet privately owned, and 27.9 billion feet publicly owned. Nearly half the saw-timber volume, 22.7 billion feet, is western hemlock; only 8.9 billion feet of Douglas-fir remains in the unit. The unit has a population of 70,000; the majority are dependent upon the forest industries for a livelihood.

The object of the study is to make possible the formulation of a constructive program of future social and economic management of the forest resources. It will include the following: A revised forest inventory, an estimate of present and prospective growth, an analysis of past and present forest drain and a forecast of future drain, a survey of primary and secondary wood-using industries and products, a study of tax delinquency of forest lands and an analysis of trends in forest land ownership, a study of the relationship of forest industries to supply of raw materials, a realistic appraisal of future timber supplies, study of current woods utilization and forest management practice, preparation of a sustained yield cutting budget, correlation of forest data with other economic data, and preparation of a local forest program.

The revised inventory is completed, growth calculations are well along, field work is under way on the tax delinquency phase by the Division of Forest Economics, and the survey of wood-using industries by the Division of Forest Products will get under way early in June.

FOREST SURVEY

Appalachian

Inventory. The computational work for the Virginia Survey units received a setback with the recent announcement by the Bureau of the Census of new land area figures for the state. Area

and volume data had been computed for approximately half of the state on the old basis and must be revised in accordance with new figures. As areas of other states in the Station's territory have also been revised, adjustments will be necessary in the data previously compiled for South Carolina and North Carolina.

Girard, with the assistance of Survey staff members, completed the volume table field work for the mountain units in Virginia, and preparation of these tables is now under way.

Drain. The field canvass of Virginia wood using industries has covered two-thirds of the state and should be completed in July. Field checking of mills in North Carolina and South Carolina that did not reply to the Census questionnaire was started early in May with one man in each state. Many new mills are being found in these states as a result of the rapid expansion in the lumber market during the past few months. The peak of production seems to have been reached in the latter part of last year to meet the needs of the defense orders. Since then there has been a general decline in mill activity and production at present seems to be only slightly above the average for the past three years.

Reports. Two survey releases were issued during May:

Forest Survey Release No. 8, The Distribution of Commercial Forest Trees in North Carolina.

Forest Survey Release No. 9, The Distribution of Commercial Forest Trees in South Carolina.

These reports are a departure from previous survey releases in that they are designed to show the location of concentrations of trees of commercial species and sizes. Originally prepared from plot sheets for staff use in analysing and interpreting survey data, they proved so useful that they have been made available as releases.

Lake States

On May 10, R. N. Cunningham returned from a 2-month detail in Washington where he assisted in a special analysis of the Lake States forest situation for the benefit of the Secretary's Office. This resulted in a communication from the Secretary to the Editor of the Minneapolis Star Journal which was featured in a Sunday issue. Another communication will be forthcoming in the near future.

The Census of 1940 production of lumber in Lake States mills was brought nearly to completion with the aid of two temporary field agents. Final production figures for Minnesota, subject to correction only by the Bureau of Census, are 33 percent above the 1939 level.

Northern Rocky Mountain

Inventory. Field work west of the Continental Divide was started May 5. A crew of four men covered 385,000 acres of forest and nonforest land since that date. Our efforts are directed toward completing the field work in the Inland Empire during the current season, which means covering an additional 2.1 million acres.

Field work east of the Continental Divide initiated in November 1940 and financed by W.P.A. funds was temporarily suspended June 1 of this year. This action was taken because of the loss of field supervisor Brown to the Army under the Selective Service Act and because it was deemed advisable to concentrate all available trained field men in the Inland Empire area.

The area covered east of the Divide during the 8-month period since the work was initiated approximates 6.3 million acres including all of Choteau County, most of Fergus County, and portions of Judith Basin and Cascade Counties.

Growth. Current annual growth in Lake County (exclusive of fire losses) according to recently completed calculations amounts to 19.9 million board feet Scribner scale, or 4.1 million cubic feet in trees larger than 5 inches d.b.h. Growth of ponderosa pine, the most valuable of the leading species, is 6.8 million board feet of which 5.7 million feet is occurring in pole, seedling and sapling stands. Most of the ponderosa pine saw-timber stands have passed the stage of net growth as indicated by the following table showing the board foot growth percent of the principal species by stand class:

Species	Saw-timber stands	Pole, seedling and sapling stands
	Board feet	Percent
Ponderosa pine	0.3	8.5
Western larch	0.4	5.5
All other species	0.3	5.4
Total all species	0.3	6.4

Compilation. Lake County, according to the summarized inventory data, has a total land area of 949.7 M acres of which 536.6 M acres is forest land. Commercial forest land totals 444.9 M acres.

The board foot Scribner volume totals 1,944.4 million of which 1,778.0 million board feet occurs in saw-timber stands. The remainder occurs in pole, seedling and sapling stands - stands averaging less than 3 or 4 M board feet per acre.

Pacific Northwest

General. Substituting for Director Wyckoff, Cowlin attended the Social Science Research Conference of the Pacific Coast at Pacific Grove, Calif., April 10-12. This annual conference of social scientists is sponsored by the Social Science Research Council and its meetings are conducted on a group-discussion plan with reports of the group deliberations presented at Plenary sessions of the conference. "The Role of Research in Planning Regional Development: The Pacific Northwest" was the subject of the group meetings attended by Cowlin.

Plans for the Grays Harbor unit study were presented to a group of local people at Aberdeen and Hoquiam by Wyckoff and Cowlin.

A joint meeting of the Society of American Foresters and Forest Practice Committee of the Western Pine Association was held at Klamath Falls. The general program topic was "Sustained Forest Production in the Klamath Region." Data on present timber resources, cutting drain, and estimated growth replacement under different degrees of cutting were presented by Cowlin, Johnson, and Briegleb, respectively. A graphic presentation proved effective. A wall-size chart showing basic data was constructed on the spot; as each speaker gave his talk, colored strips were pasted on the chart showing drain, growth, etc. These were cut to size and a skeletonized background prepared in advance so the chart was made without any slowing up of the speaker's address.

Local presentation of survey analyses of the forest situation such as was done in Grays Harbor and Klamath Falls are proving to be productive.

Douglas-Fir Region

Keeping Findings Current. Compilation of type areas and timber volumes have been completed for Polk and Benton Counties, Oregon, and Jefferson County, Washington, leaving only Mason County, Washington, to complete. Field work for 1941 commenced in King County, Washington.

Interpretation and Analysis. Reports giving revised forest statistics were issued for Kitsap County, Washington, and Polk County, Oregon. An article presenting data on forest resources of Oregon and Washington was prepared and printed in The Banker. This is the first of a series of six articles on various aspects of the forest problem to be printed in this journal which is circulated among the banking and financial interests of the Pacific Northwest. Two articles on the forest situation in the Willamette River district were prepared for publication in the West Coast Lumberman.

Revised current and potential growth estimates were completed for the Grays Harbor unit. These were made by county and ownership class in cubic feet and in two standards of measurement by board feet. In addition current growth was estimated by forest type; potential was estimated for Douglas-fir sites and spruce-hemlock sites separately. The revised inventory statistics were of course used as a basis throughout. The technique differed from that employed in the original estimates in that the spruce-hemlock yield table, U.S.D.A. Tech. Bull. No. 544, was used in estimating the growth for spruce-hemlock and upper-slope types and sites, the Douglas-fir yield table (U.S.D.A. Tech. Bull. No. 201) for the Douglas-fir and western redcedar types and sites. In the original computations the Douglas-fir table was used for all conifer types. A summary of results and comparison with originals follows.

Revised periodic growth estimates were completed up to the point of applying new depletion estimates to them.

Substantial progress was made on laying the ground work for the proposed study of possible improvements in methods of making survey growth estimates to be undertaken by Girard and Briegleb next month. A new volume table for second-growth Douglas-fir conforming to the forest survey standards of measurements was completed. When applied to the 177 trees (taken throughout the region) from which it was made, it checked within less than 0.1 percent of their actual scale. Special analyses of permanent sample plot data that will be helpful in this attempt to improve growth predicting methods were initiated.

Extracts From Findings

Grays Harbor Unit
Potential Annual Growth Estimates

County	Trees 5.1"+ 1/		Trees 11.1"+		Trees 15.1"+	
	1935	1941	1935	1941	1935	1941
	Million cu. ft.	Million cu. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.	Million bd. ft.
West Jefferson	62	70	290	390	202	305
Grays Harbor	133	143	662	803	480	627
Pacific	69	75	345	425	251	333
Total	264	288	1,297	1,618	933	1,265

Current Annual Growth Estimates

County	Trees 5.1"+ 1/		Trees 11.1"+		Trees 15.1"+	
	1935	1941	1935	1941	1935	1941
	Million cu.ft.	Million cu.ft	Million bd.ft.	Million bd.ft.	Million bd.ft.	Million bd.ft.
West Jefferson	2	2	--	7	3	5
Grays Harbor	36	36	--	203	95	141
Pacific	24	23	--	166	67	132
Total	62	61	--	376	165	278

1/ Actually 1.5"+ for the 1935 estimates. The new cubic foot yield tables for trees 5.1"+ made this spring for spruce-hemlock and Douglas-fir were used for the 1941 estimates.

FOREST TAXATION AND INSURANCE

Pacific Northwest

Taxation. Some progress was made in writing the report on local government adaption with special reference to the forest areas in the State of Washington. The outline has been again revised. This report begins with a description of the present situation or problems in local government in the State and will include a discussion of various methods of action which might be taken to introduce flexibility into the local government and make it adaptable to the needs of the areas and communities, and overcome some of its handicaps to forestry.

Two special forest tax measures were before the Washington Legislature this year:

One, a deferred timber tax measure, was passed and signed by the Governor on March 21, becoming Chapter 120 of the Laws of 1941. This law provides for land and timber to be taxed separately. An increasing amount of timber tax may be deferred each year until on and after the tenth year of classification a maximum amount of 75 percent of the timber tax may be deferred. The deferred tax is cumulative until it equals 25 percent of the assessed value of the timber. It is provided that the cumulative deferred tax payable upon the harvesting of the timber shall never exceed 25 percent of the assessed value. The cumulative deferred tax draws simple interest at the rate of 3 percent, payable annually at the same time as the current tax. Assuming no change in assessed valuation and a continuation of usual tax rates, the maximum deferment, 25 percent of assessed value, will be

reached in about 16 years after classification. If timber is held longer, a portion of the timber tax will in effect be cancelled.

The second forest tax bill introduced in Washington would provide for the declassification of lands classified under the present fixed assessment and yield tax law "whenever the owner of such lands desires to transfer the same by sale or exchange to the Federal Government or the State of Washington." This measure failed to pass.

There has been very little activity in connection with the Washington yield tax law. During the past two years no land has been either classified or declassified under the law. There has been a slight amount of cutting on classified lands, but somewhat less than $200 in yield taxes was paid during the past two years.

Tax rates in effect for 1941 in each tax district of the State of Oregon have been assembled and tabulated. There was not a great change between 1940 and 1941 in the general tax rates which are applicable to the entire rural area in each Oregon county. Only in Clackamas and Polk Counties was there a decrease in general tax rates of more than 5 mills. There was some decrease in the general tax rate in 24 Oregon counties and some increase in the other 12 counties; however, in no county was the increase as much as two mills. There is some tendency for differences between counties to be augmented; that is, the three counties with the highest tax rates increased their general tax rate in 1941, and the ten counties with the lowest tax rates decreased their general tax rate in 1941. The range in total tax rates was about the same in 1941 as in 1940 in 24 of the 36 counties. In 10 counties the range in total tax rates due to district taxes increased by more than 5 mills, while only in two counties did this range decrease by more than 5 mills in 1941. Sudden large changes in individual district tax rates occur. They are due to various causes such as changes in tax base as a result of forfeiture of tax delinquent land or the cutting of timber, and sudden increases or decreases in district tax requirements.

The Oregon State Tax Commission has ruled that the variable ratio assessment practice which has been in effect in Multnomah County (Portland) for many years is not in conformity with the law. As a result there will be radical changes in assessed valuations as of 1941. According to the Assessor's own testimony lands have been assessed at from 60 to 75 percent of market value, buildings 30 to 40 percent, personal property 50 percent, merchandise in wholesale trade 60 percent, and public utilities 53 percent of market value. As a result of the Tax Commission ruling the Assessor is now undertaking to assess all classes of property at the uniform ratio of 60 percent of full market value. This will result in a reduction of about 20 percent in the tax rate as applied to assessed value. The State law of Oregon provides that all classes of taxable property shall be assessed at full cash value.

NEW PUBLIC DOMAIN

Lake States

Forestry Legislation in Minnesota. The 1941 Minnesota Legislature, which adjourned late in April, enacted several laws pertaining to forestry and forest lands, some of which were in line with 1939 and 1941 recommendations of the Forestry Interim Commission with which the Station has had close relations. Amendments to the land exchange law are designed to make workable the legislation of 1939 authorizing exchange of state and tax-forfeited lands. Another law requires identification as to origin and ownership of all logs and timber in transit on highways, as a device for control of trespass. Amendments to the tax-forfeited land law are intended to facilitate establishment of community forests and transfers of such land to the State.

Of particular interest is the appropriation of 10 percent of the Occupation Tax on iron ore for purpose of developing unused resources in the northern counties. This fund is to be appropriated automatically each year, and may amount to about one-half million dollars per year. Administration is placed under a new department -- the "Commissioner of Iron Range Resources and Rehabilitation." According to best information the legislature had no specific work in mind when the appropriation was made, but it stands to reason that it should be chiefly devoted to forestry and other wild-land resources.

Pacific Northwest

In keeping with long-established policy, the main body of the New Public Domain report was subjected to review and criticism by several staff members—this in the interest of securing the extraordinarily careful analytical and synthetic treatment so needed in this extremely complex region. Completion of reviews is expected in June. In the interim, Wilson has been engaged in gathering field data for the New Public Domain phase of the all-Station Grays Harbor unit study more particularly described in the General section of this report.

Central States

Illinois Farm Woodland Study. In the Illinois Farm Woodland Study, the tables were completed for the section on farm production and consumption of forest products, and consumption of competing products. Steel posts and coal for fuel were the main competing products purchased.

The manuscript was prepared for the farm woodland phase of this study, later to be included in the main report dealing also with pastures and buildings on these farms.

Lake States

Forest Cooperatives. Through the efforts of the Station and the Forest Supervisor a meeting was held at Cass Lake, Minnesota, on April 24, to discuss ways and means of helping the small operators in the vicinity of the Chippewa National Forest and the Pike Bay Experimental Forest to solve their financing and marketing problems.

The Farm Security Administration, the Extension Service, and the Solicitor's Office, as well as the Forest Service were represented. F. H. Eyre of the Station and several members of the Chippewa National Forest staff presented the problems of the small operators. Full cooperation of all the agencies represented was assured, and a local committee was set up in Itasca County to look further into possibilities for cooperative action.

On May 26, Paul Zehngraff again met with the Farm Security men to work out the details for loans to a few of the small operators on the Pike Bay Forest. Thus some financial aid to these farmer-loggers and small operators seems assured.

An earlier meeting with the manager of the Range Cooperative Federation at Virginia, Minnesota, had obtained promise of some assistance from that quarter in marketing timber cooperatively. The Range Cooperative Federation is already marketing a considerable volume of pulpwood and ties from its members in the northeastern portion of the Chippewa Forest. Last year they handled $125,000. worth of timber and expect to expand this business. In order to handle a greater business not only in timber but also in other farm products, a cooperative terminal is being set up in Duluth which may go a long way towards solving the financing as well as the marketing problems of the small timber producers who are now so much at the mercy of the timber brokers and of the discriminatory buying practices of some of the mills.

The Director and H. G. White of this Station also attended a meeting of the newly organized Upper Peninsula Timber Producers Association at Iron River, Michigan, on May 23. The main purpose of the meeting was to organize an independent mutual insurance company to carry workman's compensation, but the subject of cooperative marketing of timber products also came up for consideration. Although this organization includes many of the larger independent operators they sometimes feel the pinch of marketing individually to mills that are in a position to control market prices. At the dinner meeting H. G. White spoke on the advantages of cooperative marketing, not only in improving prices but also in making possible better utilization and better cutting practices.

Northeastern

Farm Forestry - Connecticut. Bids were sent out on June 2 to contractors for the installation of equipment for burning hogged fuel at the Niantic State Farm for Women. Acceptance of bids and purchase of equipment will be made by the State Forester prior to July 1 and the necessary work of installation will be done in July and August.

The cost study of fuelwood production indicates that no material savings can be expected in producing fuelwood in lengths of 8' and 12' over 4' wood where the product is to be sticks, but that real savings can be made in the case of 12' wood and tree lengths where the end product is to be hogged fuel. The data were all strongly influenced by the type of labor it was necessary to use and should be supported by similar studies of contract jobs.

Work on the portable charcoal kilns has been speeded up and it is hoped that a kiln will be ready by July 15 for release. Reports covering the entire job will be prepared at that time. A one-cord kiln, square in design, is now being operated with quite a marked degree of precision, producing a uniform, good quality charcoal. A four cord square kiln is being operated in accordance with findings derived from the operation of the smaller kiln. Results are promising though there is apparently some characteristic developing in the larger kiln not found in the smaller.

Southern

Work was continued in the preparation of a report combining the results of surveys of silvicultural conditions in the woodlands of two counties typical of the Piedmont and Upper Coastal plains of central Alabama. This report will be published by the Alabama Agricultural Experiment Station.

Final sowings were made on a series of plots established to test the possibilities of complete and periodic direct seeding with loblolly pine on old field and forest areas.

A number of small nursery beds were established on carefully selected sites in an attempt to develop a simple method of growing loblolly pine seedlings near areas needing planting.

Field work was completed on a survey of the "Little-Leaf" disease of shortleaf and other pines in central Alabama. This survey is a cooperative project of several state and federal agencies. Its primary purposes are:

1. To furnish a more complete picture of the extent and importance of this disease.

2. To indicate the volume and class of material affected.

3. To show what changes in stand composition are likely to result from this condition.

Summary and analysis of the data collected has been started.

RANGE ECONOMICS

Intermountain

Lambing Permits on the Fishlake and Manti National Forests in Central Utah. One of the pressing problems in range administration on the Manti and Fishlake National Forests is the early range use by sheep permitted to lamb on these forests. Located in central Utah these forests range in elevation from 5,000 to 10,000 feet. Some of the lambing range lies at elevations of 8,000 feet and use of this range starts the 21st of May. It is readily apparent that this is before vegetative readiness. In order to bring about proper seasonal use it is necessary that these lambing permits be discontinued where they are causing deterioration of the grazing resource.

In order to determine what kind of adjustments are available to the operators a comprehensive study of their farm or ranch organization has been made. There are more than 200 lambing permits on these forests but these are controlled, either by ownership or lease, by about 100 operating units. Some operations control more than a half dozen lambing permits. The farm and ranch organization data for these permittees have been sorted into three size classes based on the number of sheep owned. The three size classes and the number of operating units in each are as follows: (1) 0-300 sheep, 19 units; (2) 301-1,500 sheep, 42 units; (3) over 1,500 sheep, 31 units. The average set-up in the small size class, 0-300 head, operated 59 acres of crop land, 210 acres of range and pasture land, and 181 head of sheep. This is an average of 0.33 acre of crop land and 1.1 acres of range and pasture land per sheep. For the size class 301-1,500 sheep, the average size of operation was 89 acres of crop land, 822 acres of range and pasture land, and 772 sheep, an average of 0.12 acre of crop land and 1 acre of range per sheep. The average unit for the largest size class was 111 acres of crop land, 2,688 acres of range and pasture land, and 1,610 sheep, or 0.5 acre of crop land and 1.9 acres of range or pasture per head of sheep. Two-thirds of the crop land in each size class was devoted to hay with the remainder in miscellaneous cash crops such as wheat and sugar beets and such feed grains as barley and oats.

The probable gross income for each size class running from smallest to largest was $1,632, $4,397, and $8,544 respectively. In the 0-300 head class 32 percent of the probable gross income per operating unit was obtained from crops whereas in the other two classes it was 7 percent and less than 1 percent respectively. In the smallest class 50 percent of the total probable gross income was from range sheep; in the size class 301-1,500 it was 73 percent; and in the largest class 86 percent.

The proportion of the number of sheep owned that were permitted to lamb on the forests is of considerable significance. The smallest class had 68 percent of its sheep lambing on the forest, the middle-sized class 59 percent, and the largest class only 26 percent. These operating units controlled 148,000 sheep of which 51,000, or one-third, are permitted to lamb on the forest.

The amount of public grazing secured by these operating units is of much interest. The size class 0-300 head secured 59 percent of the annual feed required by sheep from the public ranges; 20 percent was from the forests, and 31 percent from the grazing districts. 1/ All but 4 of the 19 operating units in this class had grazing district permits for winter range. In the other two size classes, 69 percent of the annual feed requirements for sheep came from the public ranges.

1/ These grazing districts are the Pahvant and San Raphael in U.S. Grazing Service, Region 2.

The percentage of the annual feed required coming from the national forests was 28 percent for the class 301-1,500 and 17 percent for the 1,501 or over class; 41 percent and 53 percent respectively came from the grazing districts. Almost all of the operating units in the two larger classes had permits for winter grazing on the grazing districts. A typical sheep outfit having a forest permit secures about 6 months of winter grazing from the grazing districts and about 4 months on the forest for sheep not permitted to lamb, and 5 months for sheep permitted to lamb on the forests. The remainder of the forage required during the year comes from the private ranges and feed crop producing lands.

In determining which size of sheep operations should be restricted in its use of forest lambing ranges it is significant that the largest size class contains 58 percent of all the sheep lambing on the forests. The smallest class, 0-300 sheep, contains only 5 percent of the lambers. With such a small amount of private land controlled per sheep in all size classes, including both crop and range land, it is evident that a reduction in the lambing use probably will require a reduction in the number of sheep operated.2/ However, this may not be true for the smallest size class that have ample crop land. The range in size of operating unit having lambing permits is extremely great, from less than 100 head to over 8,000 sheep. From a sociological standpoint it might be desirable to reduce the largest operations since they would still secure a desirable standard of living. On the other hand, from a pure economic and land use standpoint it is probable that these larger operations are more economical and have a better land use relationship. Then, too, the smallest lambing operations only secure 50 percent of their probable gross income from range sheep.

The size of operation that should be reduced will depend largely on the agricultural policy of the nation as a whole. That is, what size of operation should the federal government seek to foster? All of these operations are obtaining over 50 percent of the annual feed for sheep from the public ranges which is somewhat more than is obtained from the average sheep operation in this area. For this reason it would seem that they should be able to adjust their operations to a loss of their lambing permits and still be able to compete with other sheep producers of the area.

If it is necessary from a conservation standpoint to take away all of these lambing privileges, it will undoubtedly affect the gross income of these permittees.3/ The smaller operations can

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2/ Unless of course other private range can be secured. This is not likely in central Utah where the pressure of livestock numbers on the range is extremely great.

3/ It seems that generally speaking most farm and ranch operators think largely in terms of gross rather than net income.

probably handle the lambing season by using harvested feeds. The larger operations will be forced to reduce their numbers but this reduction will only be a small percentage since in the largest class they have only 28 percent of their sheep lambing on the national forests. These larger size classes can still have a good standard of living even with reduced numbers of sheep. Furthermore, there is evidence that by better management and use of good range the number of lambs saved per 100 sheep can be increased which will tend to maintain the net income even with somewhat reduced sheep numbers.

FOREST MANAGEMENT RESEARCH

FOREST FIRE PROTECTION

Appalachian

Fire Damage Appraisal. The new fire damage appraisal system, mentioned in previous reports, was released early in April as a technical note. The response to date has been very favorable, and several agencies plan to study the system and its application in preparation for a trial during the fall fire season.

Fire Prevention. In this region where about 99 percent of forest fires are man-caused, prevention is the number one fire problem. Also, since smoker fires make up at least one-fifth of the total number, considerable emphasis should be placed on prevention of fires resulting from discarded smoking materials. To provide a better basis for directing prevention efforts, Keetch recently summarized all available information on fire brand tests, conducted in past years by research organizations, giving particular attention to cigarettes and matches as fire starters. The match proved to be the most dangerous agent while the cigarette apparently rarely causes ignition in anything but rotted wood and then only if wind is blowing at a favorable velocity.

The effectiveness of all fire starters tested is listed below in descending order.

1. Broadcast slash burning fires.
2. Large bonfires.
3. Small campfires.
4. Matches (kitchen stick variety).
5. Safety matches and book matches.
6. Pipe heels.
7. Locomotive sparks and glowing embers.
8. Fast-burning cigarettes.
9. Cigars.

The relative position of matches and cigarettes on this list indicates that perhaps more emphasis in prevention should be placed on the match than on the cigarette.

Lake States

The study of the effect of cover on fire danger which for the past few years has been under way in northern hardwoods on the Nicolet National Forest was this year transferred to the Chippewa where pine prevails. To date 12 stations have been established there for the daily determination of fuel moisture. Conditions represented range all the way from full exposure to virgin timber. Observations began May 12 and will be continued throughout this fire season.

In the meantime, the data collected last year on the Nicolet is being worked up with the help of Ralph Weinstein, a Syracuse forest-school graduate, who is being employed temporarily as a Junior Agricultural Aide.

Northern Rocky Mountain

Field work at the Priest River headquarters has had to be materially curtailed this spring due to the loss of funds formerly contributed by the regional office. When V. L. Cline was drafted by the Army in April his position was abolished. Consequently, Hayes and Naiman have had to do all the Priest River work which last year employed three men, and several years ago utilized the full time of four men. As Naiman has recently been appointed as acting superintendent, replacing McKeever, at Priest River, and as the routines of this job cannot be reduced, several fire projects have suffered.

During late May, Stickel selected several areas for test fires to be made as soon as burning conditions and available CCC help will permit. Loss of the experimental forest CCC camp F-127 in early June will not expedite this work.

At the request of the regional office of fire control a previously unplanned publication is being specially prepared. This will be titled "How the Wind Blows in the Forest of Northern Idaho" and will contain preliminary charts showing, by 2-hour periods, the wind velocity beneath, up through, and into the free air 50 feet above a forest canopy. The data are from the 2-foot, 49-foot, 83-foot, 112-foot, and 156-foot measurement stations on the steel tower at Priest

River. When fire control men saw the preliminary charts prepared last winter by Naiman they immediately recognized the opportunities of practical application and requested charts and text for every smoke-chaser and dispatcher in the region. Two thousand copies are being multilithed.

Although not yet admitted by all fire control men, who can't forget the extreme deficiency of snow cover during the past winter, April and May have resulted in at least a normal and probably an easier than average opening of the fire season. At Priest River the precipitation of the first 20 days of May exceeded the most ever before received, in 30 years, for the entire month. At Missoula the May precipitation totaled 2.72 inches, which is 0.74 above average, since January 1, 1.06 inches above the true April 1 - May 31 normal based on 10-day medians, and is the wettest May in Missoula since 1932. Vegetation, such as cheat grass, yarrow, and balsamhoriza, is from 4 to 7 days behind its stage of development on June 1 last year.

Pacific Northwest

Fire Weather Studied on Partial Cut Areas. "Fire Weather on Clear-Cut, Partly Cut, and Virgin Timber Areas at Westfir, Oregon" is the title of a recent report by Morris. This case study was designed to measure and compare the fire weather factors of fire danger after various cutting practices in a decadent Douglas-fir stand which had a gross volume of about 156 M b.m. per acre. An anemometer, hygrothermograph, and several fuel moisture sticks were exposed at four stations representative of clear-cut, heavy-cut, light-cut, and uncut areas on a Forest Service timber sale. All stations were on a small plateau at approximately the same elevation. The greatest distance between any two stations was about ½ mile.

The results follow the pattern revealed by similar work of other investigators. For example, the average wind velocity from July 15 to September 1 at the different stations was as follows:

Clear-cut	2.7 miles per hour
Heavily cut	0.8 " " "
Lightly cut	0.7 " " "
Virgin timber	0.6 " " "

The average relative humidities obtained from psychrometer readings during the afternoon on 32 days without rain were as follows:

Clear-cut	37.0 percent
Heavily cut	37.4 "
Lightly cut	44.4 "
Virgin timber	49.8 "

On these same 32 afternoons the fuel moisture indicator stick values were as follows:

Clear-cut	7.5 percent
Heavily cut	8.9 "
Lightly cut	11.1 "
Virgin timber	13.1 "

These comparisons are limited to the few distinct factors of fire danger studied. Other factors, especially those related to the kind, quantity, and distribution of fuels must also be included in any comparisons of total fire danger after different degrees of partial cutting.

Fire Control on Walla Walla Watershed. An analysis was completed and a report was prepared covering the fire control problems on the 350,000 acres of forest lands in the Walla Walla Watershed in Washington and Oregon to be used as reference material in the flood control report on this area. The following are some of the headings found in the report: Analysis of climatic factors of fire danger, analysis of fire records, and fires outside the protection boundary.

Southern

Fire Danger Rating. A series of tests were made on the Conecuh National Forest in southern Alabama to determine the validity of recommending one danger station per ranger district. This work has shown that although some very significant differences in the measurement of the basic factors were obtained, one fire danger station per ranger district is adequate if sufficient care is given to the choice of site for the station.

These tests were made by obtaining simultaneous paired readings of wind and moisture at various points on the Conecuh National Forest. These data were analyzed by using the analysis of variance and the "t-test" for paired observations--each separately for wind, moisture, and rate of spread index. In addition departures from the accepted danger station were tabulated as follows:

Percent of the time that wind (m.p.h.) is higher than at danger station by more than:

Station	Miles per hour			
	1+	2+	3+	4+
	Percent of observations			
A	28	16	4	4
B	40	24	16	8
C	88	72	44	28
D	96	88	64	48
E	40	32	24	8
F	56	44	28	16

Although moisture differences showed no constant pattern of variation, rate of spread index, being largely governed by wind, follows essentially the same pattern as wind.

FOREST GENETICS

California

Breeding. In 1937 the cross Pinus echinata x P. taeda – a few of which had been obtained at the Institute of Forest Genetics previously – was attempted on a scale sufficient to yield enough seeds for a statistical study of vigor. The seeds of the hybrid and the natural progeny of the seed-parent were classified according to weight (1 milligram weight-classes) and then stratified for 2 months prior to sowing. The nursery performance of the two classes was compared by setting them out as paired tests. Seeds of the same weight were paired in order to eliminate differences in early vigor due to differences in size of seed. Germination records were taken daily, and in order to eliminate advantages arising from differences in age, seedlings having an age-advantage of more than 2 days were excluded from the comparison. Heights were measured at the end of the first and second years. Sixty pairs were included in the final analyses.

The hybrids, which could be distinguished also by taxonomic characters, surpassed the natural progeny, the difference between the two forms being highly significant at both ages. The results indicate that the two forms are members of different populations. This does not mean that the seedlings arising from the controlled pollinations are in fact interspecific hybrids, since similar results might,

presumably, be obtained merely by using P. echinata pollen from different parents. It does indicate, however, that the pollination technique is very effective. The greater vigor of the hybrid group, together with other differences, strongly suggests inter-specific hybridity; the question will be answered by further studies. Meanwhile, the plantation phase of the test is under way in order to ascertain if the initial advantage will be maintained after a number of years.

Northeastern

Hybridization and Breeding. Weather conditions during the 1941 breeding season were very unsatisfactory. At New Haven, forest species were almost 10 days behind the average year at the end of March, but the unseasonably warm weather during April pushed growth so fast that by May 1 development was 10 days ahead of the average year. This greatly increased the overlap of blooming both between and within genera, and made it impossible to work as many individuals as in previous years.

A large number of seeds were set to inter-specific cross pollinations between Acer saccharinum (♀) and A. rubrum (♂) and a somewhat lesser number between Acer rubrum (♀) and A. saccharinum (♂). Breeding with A. saccharum was not possible because the trees both at New Haven and at the Hopkins Memorial Experimental Forest produced only a medium crop of ♂ flowers and very few ♀ flowers in 1941. This species matured an extremely heavy seed crop in 1940.

Seed of Betula nigra which matures in spring has been collected and planted. The seed harvested represents selfed and inter-specific cross-combinations between Betula nigra (♀) and B. papyrifera and B. lenta (♂). The remaining birch species will not mature their seed until fall.

Racial Variation. The 14 seed lots of Norway spruce (Picea excelsa), grown as part of the international forest-tree seed test sponsored by the International Union of Forest Research Organizations, have come through the past winter in good condition. The first-year results of this work have been reported previously. The four Scandinavian progenies which made no height growth from terminal buds during the first year appear to have suffered some winter injury in spite of the fact that the beds were heavily mulched. It is impossible to determine whether this injury was due to the rather open winter at Williamstown, Massachusetts, or to some pathogen. It is now apparent that seed lot No. S-12 (W. O. number) is not Picea excelsa but apparently Pinus sp.

Physiology. Vitamin B_1 (thiamin), or its precursors, has been shown to be an important chemical in the normal functioning of green plants. The amount of these chemicals and other growth substances such as heteroauxin present in the green tissue of trees exerts a profound influence on growth. Preliminary quantitative determinations of thiamin in bud and leaf tissue of Pinus strobus by the Phycomyces assay method have shown considerable variation between trees and between portions of individual trees. Tests are also under way to determine if thiamin production, as tied up with general vigor of growth, is an hereditary factor. This is being done by the multiplication of individuals as clones by cuttings, these to be grown under identical environmental conditions and further quantitative tests for thiamin to be made at successive stages of development.

MENSURATION

Central States

Volume Tables. Four local volume tables based on data taken by the Survey in 1940 appeared and were distributed during the period. Additional data on black oak, slippery elm, white ash, beech, black gum, and basswood from Holmes County, Ohio, are in hand.

Progress was made on the tree data provided from Hamilton County, Ohio.

The Station's computing section initiated the compilation of data taken by Girard during his 13-day visit in Ohio.

Stand Studies, Growth and Yield. Plans have been completed for the remeasurement of 42 growth plots established over the northern half of Indiana 10 years ago, in cooperation with Purdue University Agricultural Experiment Station.

A report entitled "The Sylamore Experimental Forest," by John R. McGuire was completed and submitted as a Yale Forest School thesis. Prepared as a cooperative undertaking with this station, the basic data on Sylamore forest types and growth and yield records were compiled by the statistical section. Considerable information on social, industrial, and land use relations of the Ozark region are presented, together with suggestions as to how the experimental forest can most effectively serve in research program planning for the region.

Lake States

Short-Cut Scaling for Small Logs. The study of short cuts in scaling small-sized and low-grade logs of aspen and jack pine is now under way. The results of the analysis of scale-book records show considerable promise in arriving at sampling methods that will be both practical and accurate. A sample of 100 carefully measured truck loads of aspen logs, for example, indicated that when 2 million board feet of logs are involved, even a 10-percent sample will keep the error below 3 percent in 19 our of 20 cases. With 200,000 feet of logs, the error of 25-percent sampling will not exceed 5 percent. On jobs where only 100,000 feet are involved, a 40-percent sampling will also result in less than 5 percent error.

Pacific Northwest

Work in this section suffered a severe setback this period when Wesley Zellner, WPA computer who had been with the Station most of the time for 5 years, left to accept employment with the State of Oregon. The project on growth of ponderosa pine by Keen tree class progressed nicely up to Zellner's departure but has since been inactive.

Briegleb prepared a paper, "Present and Possible Forest Growth in Klamath and Lake Counties, Oregon", for the Columbia River Section, Society of American Foresters' field meeting at Klamath Falls, May 23-24.

A report on the three permanent growth-sample plots in even-aged Douglas-fir at Cascade Head Experimental Forest was completed. Located in the fog belt, this forest is noted for its heavy stands of immature spruce-hemlock, but on some of the warmer slopes several miles back from the coast are some stands of almost pure Douglas-fir that have also made very good growth. One of the plots samples a 91-year-old Douglas-fir forest whose gross saw-timber volume in live trees totals 100,704 board feet, Scribner rule, which indicates a mean annual increment of 1,107 board feet per acre. And that growth rate is still increasing because during the last six years between measurements the stand grew at the rate of 1,395 board feet per acre per year. The two other plots were established last fall in 67-year-old timber whose saw-timber stand has already reached an average volume per acre of 59,470 board feet. The indicated mean annual increment of 888 board feet per acre should increase for several decades if mortality remains normal.

Rocky Mountain

Stand Studies - Engelmann Spruce. An analysis of growth after cutting in the Engelmann spruce type indicates that on the average 33.5 percent of the total increment per acre results from poles of the reserved stand growing to the merchantable size. This varies greatly, of course, in various stands and suggests the desirability of predicting the yield of only the merchantable sized trees of the reserved stand and then later increasing the expected yields according to the pole stand as it actually exists. This method of predicting yield should give somewhat greater precision to the estimate of expected yield of a given stand than by applying a strictly average estimate for growth.

In the analysis made for spruce the dependent variable, Y, was the yield of only the merchantable sized trees of the reserved stand, and the independent variables were: reserved volume in board feet, V; number of years after cutting, T; and site index, S. Coding all data in logarithms resulted in obtaining linear relationships. The multiple correlation coefficient obtained was 0.9925 with a corresponding coefficient of determination of 0.9850. The latter indicates that 98.5 percent of the variation in yield of the merchantable reserved stand is associated with variations in the three independent variables used. The calculated regression equation is:

$$Y = 0.9133\ V + 0.3096\ T + 0.4433\ S - 0.7527,$$

in which Y, V. and S are defined above.

The yield of each plot used in the study was estimated by the equation and upon comparing the estimated and actual yields the aggregate deviation and the average percentage deviation were found to be 0.32 percent and 7.13 percent respectively.

It was found that the volume of ingrowth was but weakly correlated with the total number of poles between 3.6 and 9.5 inches d.b.h. in the reserved stand because relatively few trees below 7 inches d.b.h. could grow to merchantable size within the period of time since cutting covered by the plots in the study. However, it was found that 83 percent of all poles that attained merchantable size during the period covered by the study were those in the 7, 8, and 9-inch d.b.h. classes at the time of cutting. Accordingly the study of ingrowth was limited to those diameter classes.

The volume of ingrowth was correlated with the number of poles in the reserved stand in the 7 to 9-inch d.b.h. classes. Data were not coded but left in natural numbers. The multiple correlation coefficient obtained was 0.8560 with a corresponding coefficient of

determination of 0.7327. The calculated regression equation was:

$$I = 19.1 N + 106.8 T - 1633.7,$$

in which I is the volume of ingrowth; N is the number of poles in the 7 to 9 inch d.b.h. classes and T is the number of years after cutting.

The volume of ingrowth of each plot was estimated by the equation and upon comparing them with the actual values an aggregate error and an average percentage deviation of 0.04 percent and 44.6 percent respectively were found. A few plots in which the age of cutting was 10 years or less accounted for the very large average percentage deviation.

The volume of ingrowth for each plot was added to the estimated value of yield of the merchantable reserved stand in order to obtain an estimate of the total yield for each plot. Upon comparing the total estimated yield of all plots with the total actual yield of each plot an aggregate error and an average percentage deviation of 0.28 percent and 10.59 percent respectively were found. These errors of estimate are relatively small and indicate that satisfactory estimates of the total yield of selectively cut stands of Engelmann spruce can be made by this procedure.

REGENERATION

Appalachian

Spruce Type. Frost heaving during last winter on the red spruce and red pine direct seeding plots on the Pisgah National Forest was excessive. Half of these plots have been reseeded to test a modified use of mulch. On the Monongahela National Forest frost heaving was much less severe. Winter mortality was light for red pine and southern balsam fir and severe only on certain plots for red spruce.

Additional plots were established on the Monongahela National Forest in April to further test the use of both direct seeding and planting stock in reforestating the cutover and burned spruce type lands.

California

Grades of Planting Stock. Planting experience in the brushfields of northern California has shown that the larger grades of 1-1 ponderosa and Jeffrey pine planting stock are superior in rate of survival and early growth as compared with smaller trees. The present practice is to reject the undesirable small trees when the 1-1 stock is lifted for planting. In 1938 a study was begun at Feather River Branch to find means of eliminating the weaker stock earlier in the nursery routine. A test of the value of grading seed has just been carried through the nursery phases. Planting the 1-1 stock was completed in March to determine whether present differences in size will persist, and whether differences in field survival will be important. Comparisons of the 1-1 grades are of considerable interest, though still incomplete.

The grading procedures tested were limited to methods considered practicable in the present Region 5 planting program. The seed lots were of the standard type --mixtures of the crops of several seed trees from a single location. Separation into three size grades was accomplished by screens with round apertures. The smallest grade contained about one-fifth of the total number of seeds in the lots. Seedlings were measured and divided into three grades for each seed grade at the time of transplanting. Each transplant grade was again subdivided into three sizes for outplanting. No culling was done at any stage and care was taken in sampling to maintain representation of the full range of variation in each seed, seedling, and transplant grade. The measure of top length was taken as the distance from cotyledons (or scars) to terminus.

The 1-1 stock from the small seed was significantly shorter than stock from the other two seed grades, the average length being 2.63 inches as compared with 2.88 inches for the medium, and 3.04 inches for the large seed grade stock. Considering, as a tentative standard, that 1-1 trees with top lengths less than 2.00 inches should be rejected, the stock from the small seed had a cull percentage of 24.2 as compared with 9.6 and 8.0 for stock from the medium and large seed respectively. Doubtless screening out the smaller seed would have reduced the 1-1 cull percentage to a moderate degree. A comparatively small proportion of the variation in size of 1-1 stock is associated with range in seed size (as here specified). Estimates of reduction in costs that might result from screening are being made. At present culling at the seedling (1-0) stage appears more promising than this type of seed grading.

About 80 percent of the variation in 1-1 stock size was associated with range in size of 1-0 stock. If all 1-0 seedlings below an arbitrary limit of 1.5 inches had been rejected, about 97 percent of the 1-1 cull apparently would have been eliminated. However, such culling would have thrown out many seedlings that attained plantable size at 1-1. Final estimates of costs, the inclusion of diameter as a grading criterion, and results of field survival should enable formulating a satisfactory culling procedure.

Central States

Seed Spotting Shortleaf Pine. The establishment of shortleaf pine by seed spotting in natural or artificially made openings in forest stands to supplement, or as a substitute for, the more costly practice of planting is a possibility in the Missouri Ozarks.

This was demonstrated in a study on the effects of 5 types of seed bed preparation and two intensities of release on the survival and growth of shortleaf pine seedlings. The number of seeds germinating and seedlings surviving at the end of the first growing season was increased by removal of litter and cultivation of the soil. Survival and height growth was greatly increased by a heavy release (75% or more). On the basis of these findings it appeared desirable to study seed spotting of pine under conditions more nearly approximating those encountered in planting.

Such a study was initiated on the Mark Twain National Forest this spring. Three types of release (1) release by cutting, (2) release by girdling, and (3) no release, were used. Two methods of covering the seed (1) raking the seed into soil and (2) pressing the seed into the soil with the feet were used. Seed spots were made by removing the litter from an area 18 inches in diameter and cultivating the exposed soil. A randomized block design with three replications was used for the release treatments and split plots were used for covering treatments. One hundred and twenty spots were given each cover treatment on each of the 9 plots, making a total of 2160 spots.

Seed germination is to be checked in July and in September or October of this year. Survival and growth data will be taken each fall for the next 5 years. Observations on frost heaving and smothering by litter will be made after the first two winter seasons.

Lake States

The Seed Manual Progresses. The end of May saw the near completion of the backbone of the seed manual. All seed descriptions, except 30 to be prepared by Wakeley of the Southern Station, have been written -- a total of 428.

With this progress there has also come the departure of the remaining detailees who assisted on the manual. A. G. Chapman, of the Central States Forest Experiment Station, left for Ohio on May 10; and Miss Leta Hughey returned to Washington on May 1, after completing the bulk of the line drawings required for the manual.

Progress has not been confined to the preparation of species description, however. Drafts of text chapters were submitted by McQuilkin of the Appalachian Station and Mirov of the California Station, and in addition photographs were made of the seed of 26 species of pinus which were not otherwise illustrated.

Seed Storage Tests. In order to add to the information on how long seed remain viable, germination tests have been made during the past winter on lots of seed which have been kept in the Station's cold room for several years. Quite surprising was the fact that the small seed of yellow birch, which had been stored at about 41° F. in a corked bottle showed 44-percent germination after 12 years. Red spruce seed similarly stored, with a germination of 91 percent, showed no loss after 10 years. Black locust seed stored for 12-1/2 years at this temperature showed 56 percent in 30 days. A cutting test of the seed remaining ungerminated at the end of this period showed this particular sample to have a potential germination of 94 percent.

Winter Damage to Plantations. The Armistice Day blizzard of 1940 took a large toll of human life. It also took its toll in young plantations in many parts of the Lake States according to observations made this spring. Spottily distributed from northwestern Minnesota to western Lower Michigan, young plantations were injured. Trees below 2 feet in height were bent down and frequently broken off; trees above 2 feet often had their side branches stripped off by the heavy snow or frozen sleet which ushered in the storm over much of the region. Many larger trees were broken off by the strong winds accompanying the storm, and these also caused additional breakage in underplanting.

Mycorrhizae Problems in Conifer Nurseries on Prairie Soils. Experiments conducted in the Great Plains in conifer nurseries since 1933 indicate that lack of mycorrhizae in prairie soils is a very serious factor in causing partial or complete failure of seedbeds of such species as Scotch and jack pine, ponderosa pine to some extent, and Colorado blue and Black Hills white spruce. The junipers, particularly J. scopulorum and J. virginiana, seemed to grow quite well in prairie soils devoid of mycorrhizae.

A partial correction of adverse growing conditions for jack and Scotch pine and blue spruce was obtained by very heavy treatments of 1/4 to 3/8 fluid ounce of sulphuric acid per square foot or 1 to 1-1/2 ounces of aluminum sulphate, or when the acid was used along with a phosphate supplying fertilizer, such as 1/4 ounce of 15-30-15 nitrophoska or 1/4 to 1/2 ounce of 20 percent superphosphate per square foot.

However, the best seedbeds were obtained where three steps were followed in soil treatment. These are: (1) introduction of mycorrhizae either on boiled inoculated wheat grains or use of soil from an old established nursery where mycorrhizae are known for certain to be present; (2) supplying a high phosphate fertilizer; and (3) use of heavy acidification treatment to lower the pH from 7.5 to 6.0.

The acidification has the multiple purpose of improving the soil for spread of mycorrhizae, decreasing the damping-off, and increasing the phosphorus feeding power of certain species of conifers, especially jack and Scotch pine. In a moderately alkaline soil, these species seem to possess poor feeding power for phosphorus and show marked phosphate starvation symptoms. The introduction of mycorrhizae alone without acidification or addition of phosphates did not give satisfactory results.

The greatest contrast in results from several experiments occurred in a small 4x4-foot latin square at Towner Nursery on jack pine. The maximum difference in size of 2-0 stock from two contrasting treatments is given below.

Bed No.	Treatment per square foot	Length of top	Length of roots	Stem diameter in 64ths	Total green weight per plant
		Inches	Inches	Inches	Grams
1075C	1 lb. mycorrhizal soil	0.78	5.6	1.8	0.30
1076B	1 lb. mycorrhizal soil + 1/4 oz. sulphuric acid + 1/4 oz. nitrophoska	4.20	7.6	7.5	4.43

It was noted that the phosphate-starved seedlings from the beds which did not receive the proper treatments were very puny, had needles only 20 percent of normal length, and had extremely poor bud development.

Experiments are under way to try inoculation of clean sterile acid peat with known strains of mycorrhizae in an attempt to avoid use of soil from old established nurseries because of the pathologists' objection to this practice, since it admittedly may introduce root rot, damping-off, and other diseases to a new site. The most important obstacle to successful practical use of pure strains of mycorrhizae has been the lack of a successful carrier suitable for large-scale inoculation of nursery sites.

Southern

Winter Mortality in Cottonwood Plantations. In October 1940, at the end of their first growing season since planting, the survival of the most successful experimental cottonwood plantings on the Delta Experimental Forest was 52 to 68 percent for wildings, depending on the site. Since most of the surviving wildings were 4 to 7 feet high at that time, and taller than the surrounding weeds, brush, and vines, it was thought that there would be comparatively little further mortality. Examinations made in May 1941, however, showed that there had been considerable mortality since October. Of all wildings alive in October, 44 percent were dead in May. The October survival of 52 - 68 percent for the best plantings dropped to 35 - 45 percent, since the over-winter mortality was not as great as the average for all wildings. The best cottonwood cuttings, which had only 22 - 31 percent survival in October, dropped to 10 - 15 percent in May. Of all cuttings alive in October, 71 percent were dead in May. Experimental plantings of Oxford hybrid poplar cuttings suffered less over-winter mortality than did cottonwood, since only 35 percent of the October survivors were dead in May. The growth of the hybrids, however, is poorer than that of cottonwood.

The reason for this unexpectedly heavy over-winter mortality is not known. It may be that the very dry weather in the late summer and early fall, plus the heavy competition of surrounding weeds, brush, and vines, is simply too hard on a moisture-loving species like cottonwood. Although cottonwood will and does grow naturally on the sites planted, conditions may be so adverse for plantations that high survival cannot be obtained. In addition to the heavy over-winter mortality, many of the plants alive in May had died back to the ground and were sprouting from the root collar. There was a heavy frost last fall very soon after an unseasonably warm period that caused

height growth to become active. The frost killed the tender new shoots, as expected, but it does not seem likely that it could account for either the die-back to the ground or the actual mortality.

Southwestern

Germination of Juniper Seed. Limited seed studies were conducted in 1939 and 1940 with several woodland species to determine their germination habits. Emphasis is placed on natural regeneration, although seed have been tested under artificial conditions, as well, for purposes of comparison. Three species, Utah juniper (Juniperus utahensis), one-seed juniper (J. monosperma), and Rocky Mountain red cedar (J. scopulorum) were used in the 1940 tests, in which germination of seed planted in the natural litter under a mature tree was compared with germination of seed planted in a prepared seedbed.

Berries were collected from the 1939 crop and were subsequently dried at room temperature and cleaned. The proportion of sound seed was determined by cutting tests and three lots of seed of each species were used in the study. In December 1939 one lot of each species was planted in the surface litter under a group of pinon and juniper trees in the vicinity of Walnut Canyon. The planting was covered with a screen frame to protect it from birds and rodents, but was otherwise undisturbed. The second lot was stored dry over winter at a temperature fluctuating between 30 and 40 degrees F., then stratified in moist sand, April 1, 1940, and planted in a prepared seedbed at Fort Valley 2 months later on June 1. The third lot was stored dry at a temperature fluctuating between 30 and 40 degrees F. over winter and until June 1, when it was planted in a seedbed along with lot 2. The seedbed was watered at frequent intervals and germination on all three lots was recorded twice weekly during the summer and fall.

Germination, in percent of numbers of sound seed, by seasons, was as follows:

Species	Treatment	No. seed	No. sound seed	No. seed germinating in % of sound seed		
				1940	1941	Total
Utah juniper	Litter	1500	840	0	66	66
	Seedbed (stratified	1500	840	4	20	24
	Seedbed (untreated)	1500	840	4	20	24
One-seed juniper	Litter	1500	1425	49	0	49
	Seedbed (stratified)	1500	1425	66	0	66
	Seedbed (untreated)	1500	1425	31	0	31
Rocky Mtn. red cedar	Litter	3000	1410	1	38	39
	Seedbed (stratified)	3000	1410	1	17	18
	Seedbed (untreated)	3000	1410	1	3	4

Utah juniper and Rocky Mountain red cedar were very similar in their germination habits. For both species, and under all treatments, first year germination was very light, or absent altogether, and substantial germination was delayed until the spring of the second season. That the delayed germination was due to after ripening requirements, and not to seed coat impermeability, was indicated by the failure of naked embryos to show any signs of life when placed in germinators during the 1940 season.

For Utah juniper, stratification had no evident influence on the numbers germinating in either the 1940 or early 1941 season. The 1940 germination started a month earlier in the stratified lot, however, than in the check treatment. Total germination was two and one-half times greater in the litter than in either of the seedbed treatments.

For Rocky Mountain red cedar, stratification had no influence on first year germination, but the spring germination in 1941 of the stratified seed was much heavier than in the check treatment. As with Utah juniper, germination in the litter was far better than that in the seedbed treatments.

One-seed juniper differed markedly from the other two species in its ability to germinate readily the first season under all treatments. The stratified seed germinated 2 weeks earlier than the check lot, with twice as many seeds germinating. Germination in the litter was intermediate between the other two. A few seeds of one-seed juniper, in all lots, germinated in April 1941, but in all cases totaled less than one-half of one percent of the sound seed.

Of importance to natural regeneration is the indication that conditions in the litter under mature woodland trees are evidently favorable for both storage and germination of the three species of juniper. Records on the survival of the seedlings now growing in the litter will be continued for several seasons.

Central States

An Improved Girdling Ax. Judging from the results of preliminary trials, a specially sharpened, short-handled cruiser's ax is a more effective and efficient girdling tool than the long-handled, heavy, felling ax ordinarily used by CCC crews. This is especially true when a shallow girdle is required. The cruiser's ax is sharpened so that the cutting edge, on the bit used for girdling, is straight or slightly concave instead of convex, and all of the bevel is on the side of the bit that is next to the tree on the downward stroke of the ax. The straight cutting edge increases the width of the effective cutting surface and reduces the relative depth of the cut made by the center of the bit. The sharp bevel on the tree side of the bit also helps prevent a deep cut. The standard handle was replaced by one slightly larger in diameter to provide better control over the ax when in use. The short handle and light weight of the ax makes it faster and less fatiguing to use.

Growth Bands. A growth band for measuring small changes in tree circumference was developed this spring. The bands are made of 7/16 inch aluminum tape of the type used in the Roovers embossing machine. Individual bands are constructed in the field to fit the trees on which they are to be used. Each band is cut 5 to 6 inches longer than the circumference of the tree and is held snugly in place by a small coil spring. With the aid of specially constructed templates, a scale graduated in tenth inches is placed on one of the overlapping ends and a vernier scale is placed on the other end.

Changes in circumference as small as 1/100 of an inch can be detected and measured with these bands. In order to test their accuracy, preliminary to a detailed study of tree diameter growth, 65 bands were placed on trees ranging from 4 to 16 inches d.b.h. for observation during the current growing season. A total of 8 hours was required for constructing and attaching these 65 bands.

Lake States

Selective Cutting in Black Spruce. The Station, in cooperation with the Minnesota Forest Service, is just completing the establishment of a series of plots in an experimental selection cutting in black spruce. A total of 40 acres were cut by two methods in which only 30 percent of the volume of the timber was removed.

In the past, selection cutting in spruce has met with considerable resistance because of the higher costs and likelihood of windfall losses. These experimental cuttings, however, are sufficiently light that windfall losses are not apt to be severe. The plots are expected to furnish good data on growth after partial cutting and on the amount of mortality.

The experiment includes tests of the influence of several methods of slash disposal upon reproduction, both under the selection cutting, and in an adjoining overmature stand which had to be cut clear.

The plots are located near Big Falls in the district where the best remaining black spruce stands in Minnesota are situated.

Intermediate Cuttings in Aspen. As the result of recent studies at the Chippewa branch, which have shown that thinning from above in aspen is not a good practice, the Station is now experimenting with thinning from below. The newest set of plots will be cut as part of a 1,000-cord sale of aspen pulp and "conversion" wood in a 30-year-old stand on the Chippewa National Forest. Two methods will be tried: (1) leaving 150 of the largest and healthiest trees per acre for growth into box and match bolt material, plus the trees which are too small for "conversion" pulpwood; and (2) leaving 150 of the largest and healthiest trees per acre plus enough medium-sized and small trees to insure adequate ground cover and "trainers" for the crop trees. In addition, uncut plots and clear-cut plots will be included in the experiment for later comparison and contrast.

Thinning from below on a commercial basis may be the answer on how to utilize the many medium-sized aspen trees that become defective before the sawlog trees are ready to cut.

Northeastern

The Record-breaking New England Drought has extended to the White Mountain section of New Hampshire which normally enjoys ample precipitation thruout the year. The deficiency on the Bartlett Experimental Forest, which is within the restricted zone of maximum rain and snowfall in the region, has constantly built up this year. The following tabulation for the first 5 calendar months indicates 10-year average figures, 1941 precipitation, and monthly and accumulated deficiencies:

	MONTH					
	Jan.	Feb.	Mar.	Apr.	May	5-Mo.Total
10-year Average (1931-40)	5.61"	4.01"	5.26"	4.64"	3.38"	22.90"
1941 Precipitation	2.04	2.63	2.42	.15	2.59	9.83
Monthly Deficiency	3.57	1.38	2.84	4.49	.79	13.07
Accumulated Deficiency		4.95	7.79	12.28	13.07	13.07

The April 1941 precipitation of .15" was well below the two previous monthly minimums of .58" and .27" recorded in October 1935 and October 1940 respectively. Since data have been obtained at Bartlett, precipitation in a single month has twice exceeded the 5-month figure, 10.07" in February 1938, 21.66" in March 1936.

In spite of the dry weather local streams are maintaining their flow reasonably well and conditions on the Forest are less critical than might be anticipated. This can probably be at least partially attributed to spring conditions, a slow melting of the winters snow with an unusually high proportion of the resulting water soaking into the ground.

Hurrican Losses in Spruce-Hardwoods. Preliminary analysis of data obtained in the 1940 remeasurement of a set of girdling plots in Corbin Park, New Hampshire, gives some indication of the extent of loss inflicted by the hurricane of September 21, 1938. The Corbin Park girdling plots which have been remeasured at regular intervals for the past 35 years were established to determine (1) the effect of selective girdling on the growth, quality, and soundness of the remaining timber, (2) the feasibility of converting a mixed spruce-hardwood stand into a pure stand of conifers. At the time of plot establishment the hardwood stands on Plots 1 and 2 were practically uniform, their basal areas amounting to 109 and 112 square feet respectively.

With the above objectives in mind, approximately 70 percent of the hardwoods were girdled on Plot 1 and approximately 90 percent on Plot 2. It will be seen from the accompanying table that hardwoods on both the moderately and heavily girdled plots with a basal area loss of 59.3 percent and 32.7 percent sustained a heavier loss than the conifers which suffered losses of only 10.0 percent and 25.5 percent respectively. The extent of conifers and hardwood losses appear to vary with composition. Note that where hardwood representation is low conifer losses are high as is the case in Plot 2 where basal area of hardwood amounts to but 13.88 square feet as opposed to 78.99 square feet of conifers. On the other hand, on plot 1 which has nearly twice as much basal area as Plot 2, conifer basal area loss amounts to but 10 percent as opposed to a 25.5 percent loss on Plot 2.

More data are needed, of course, to determine whether the relationships indicated above have any real significance.

Basal area and number of trees damaged per acre by hurricane of 1938

Plot No.	Species	Damaged trees		Undamaged trees		Total trees		Percent damaged	
		No.	B.A. sq.ft.	No.	B.A. sq.ft.	No.	B.A. sq.ft.	No.	B.A. sq.ft.
1	Spruce	70	7.49	608	67.16	678	74.65	10.3	10.0
	Hardwoods	56	36.90	74	25.32	130	62.22	43.1	59.3
	All trees	126	44.39	688	92.48	808	136.87	15.6	32.4
2	Spruce	258	12.99	580	78.99	838	106.09	30.8	25.5
	Hardwoods	32	5.22	66	13.88	98	20.61	32.6	32.7
	All trees	290	18.81	646	92.87	936	126.70	31.0	25.9

Northern Rocky Mountain

McKeever Assigned to Direct Seeding Project. D. G. McKeever, who has been superintendent of the Priest River Experimental Forest for the past 3 years, was assigned to take charge of the direct seeding project, effective May 1. McKeever replaces C. S. Schopmeyer, who was transferred to a permanent berth at the Intermountain Station in March. McKeever is especially well fitted to take over the direct seeding work as he did graduate work at the University of Idaho on basic studies of seed.

The direct seeding project will be given an impetus by the decision of the Fish and Wildlife Service to station a junior biologist with the Northern Rocky Mountain Station effective about July 1. Tentative plans call for studies of rodents in relation to artificial reforestation as one of his main projects. Mr. Horn of the Fish and Wildlife Service visited Missoula in May to discuss problems and arrange for stationing the junior biologist here. With this move, chances are good for the working out of some of our knotty problems in the direct seeding field.

Distribution of Volume in Ponderosa Pine of Western Montana and Northern Idaho. Especially constructed for cruisers and timber sales men is the following table giving the volume contained in each log of ponderosa pine trees growing in western Montana and northern Idaho.

Percentage distribution of gross merchantable volume by logs in ponderosa pine trees of different numbers of logs per tree

(Basis of volume: Scribner Dec. C log rule)

Log position in tree	Percentage of distribution of gross merchantable volume by number of 16-foot logs per tree						
	2	3	4	5	6	7	8
Butt	62	47	38	32	28	25	23
2	38	34	30	27	24	22	20
3		19	21	20	19	19	18
4			11	14	15	15	15
5				7	9	10	11
6					5	6	7
7						3	4
8							2
Total gross merchantable volume all logs	100	100	100	100	100	100	100
Basis (trees)	89	381	426	167	39	21	7

Based on 1,130 trees, 10 to 44 inches in diameter at breast height, from western Montana and northern Idaho.

The term "gross merchantable volume" as used in the table refers to the volume of wood between the stump and the top end of the last utilized log. It includes utilized logs and also all waste material such as breakage, cull logs, and defect within utilized logs.

The figures apply to all diameters of trees from 10 to 44 inches. The height of the tree, expressed in terms of 16-foot logs, influences the percent of volume in different logs but diameter has little effect.

Pacific Northwest

General. The Pringle Falls Experimental Forest was reopened May 1 with Donald McKay again as resident CCC foreman. A side camp of 11 enrollees is quartered there in the new crew house.

Several forest school groups have visited the three experimental forests this month, particularly Wind River, which had five groups aggregating about 120 students and professors who stayed one or two nights.

Each group has been escorted over the experimental forest by one of the staff who in the evening held an informal seminar.

The first Oregon Research Conference, called by the Northwest Regional Council, was held in Salem on April 19, at which T. T. Munger represented the Station. In connection with a vacation trip in April, Munger visited the Deception Creek Experimental Forest where he was shown about by Mr. Wellner, and after the Klamath Falls meeting he went to the Forest Genetics Institute at Placerville to get a first-hand glimpse of the interesting work being done there.

Silvics - Douglas-Fir. Isaac has spent considerable of this period in the establishment and reexamination of plots on experimental selective cutting timber sales on the national forests. A new sale on the Mount Hood National Forest affords an opportunity to study an area where the marking has been quite light and aimed to keep the slash hazard to a minimum. On another area a mediumly heavy cutting has been followed by hand-piling of slash at a cost of $10.50 per acre.

Silvics - Ponderosa Pine. At the recent joint meeting and field conference of the Forest Practice Committee, of the Western Pine Association, and of the local section of the Society of American Foresters a field demonstration of very light "sanitation-salvage marking" was given. The area treated by the Weyerhaeuser Timber Company a year ago in this fashion shows a striking diminution of bark beetle activity.

Stand Improvement. Kachin visited stand improvement projects in eastern Oregon and directed a time study of spot thinning and pruning work on the Whitman Forest.

The time study of 35-foot pruning with climbers and Hebo club, undertaken last winter on the Willamette Forest, has been compiled and analyzed. It was found that actual climbing and pruning time for an average CCC pruner was 5.8 minutes per tree, but walking, resting, and other time expenditures were 6.9 minutes, or about 54 percent of the total time expended per tree. This indicates a need for improved methods of crew training and organization. The test of the handsaws versus Hebo club showed that the latter is two times as fast as the first on the basis of actual pruning time.

Plans for a comprehensive study of the effects of different intensity of live limb pruning in ponderosa pine were made and the area selected at Pringle Falls. A spot-thinning experiment has also been planned for a sapling-small pole ponderosa pine stand at Pringle Falls.

Southern

In 1919 a tract of 1500 acres of cut-over land owned by the Urania Lumber Company was enclosed with hog-tight fence and later leased to the Station for experimental purposes. When this tract was logged in 1909-10, the composition was chiefly longleaf and shortleaf pine. From the time of logging until the fence was built, natural reproduction was subject to numerous uncontrolled fires and the area served as an open range for hogs and other livestock. In general hogs prevented the establishment of longleaf and fires destroyed the natural reproduction of other species of pine, thereby favoring the invasion of undesirable hardwoods.

In 1933 plans were developed to use CCC labor in releasing pine reproduction, which had developed after fencing. These plans called for the use of the entire tract in the experiment. The tract was divided into three parts, which were handled as follows: (1) no treatment; (2) all hardwoods over-topping pine and those whose crowns were within two feet of a pine were cut, except that sound white oak, red oak, and red gum better than the pines needing release were left; (3) all hardwoods were cut clear. In addition to these three principal areas, a number of smaller plots were used for special treatments in the eradication of hardwoods.

In treatment 2 the field crews were instructed to either cut or girdle the hardwoods, depending upon which treatment required the least labor. The cutting was to be done at the height most convenient for the workmen. In treatment 3, the instructions were to either cut or girdle all hardwoods. Since pine seed trees were generally present throughout the tract, openings made by removal of all hardwoods was intended to favor the establishment of pine reproduction.

In February and March 1941, a field examination was made in which this tract was sampled to determine the effectiveness of this release cutting on increasing the number of pines in the various crown classes. The field examination also covered mortality, sprout height, number of sprouts in treated hardwoods as well as extent of their present competition with pine.

Although the amount of pine has increased greatly since this tract was fenced, the protection from hogs has not been very effective in increasing the longleaf pine reproduction. Other requirements for longleaf establishment apparently have not been met since the tract was fenced. Evidently the rather heavy growth of hardwoods on portions of the tract has retarded longleaf reproduction.

Loblolly and shortleaf have increased rapidly since protection has been provided and results of the field examination indicate eventually a complete stocking of pine will become established wherever severe hardwood competition is eliminated. At present computation of the field data is incomplete, however, in general one treatment of the hardwoods has effectively released the pine, enabling it to compete successfully with subsequent sprout growth. Apparently the most valuable release work on this tract is the girdling of large unmerchantable hardwoods over dense pine reproduction. Such hardwoods produce only weak sprouts or none at all and the treatment of a single tree usually liberates a large number of small pines. In general the pine has maintained a favorable crown position after release from young hardwoods despite their vigorous sprout development following treatment.

FOREST PRODUCTS

FOREST PRODUCTS STATISTICS

Northern Rocky Mountain

Wholesale Lumber Prices. Recent wholesale lumber prices in the Northern Rocky Mountain Region compiled by the Division of Forest Products appear below:

Average Wholesale Lumber Selling Prices [1]
(N. E. Washington, Idaho, Montana)

	Average 1940	March 1941	1st Qtr. 1941
Idaho white pine	33.06	38.92	37.40
Ponderosa pine	26.97	32.91	31.66
Larch and Douglas-fir	21.20	21.76	22.99
White fir	19.50	22.66	22.55
Engelmann spruce	23.55	27.48	27.16
Western redcedar	25.20	26.22	25.42

1/ Prices include commissions and discounts.

Lumber Census. Completed reports resulting from the final mop-up of the last few dilatory establishments in southern Idaho were transmitted to Washington on April 25. The following preliminary 1940 production figures for Idaho and Montana, approved by the Bureau of the Census, were released on May 15:

Lumber Cut by Species, M Feet B.M.
(Mills cutting 50 M or over)

Kind of wood	Idaho	Montana	Combined Cut	
			Volume	Percent
Idaho white pine	421,698	26,962	448,660	40.8
Ponderosa pine	216,685	145,684	362,369	33.0
Douglas-fir	72,028	62,328	134,356	12.2
Western larch	28,036	75,493	103,529	9.4
White fir	16,498	87	16,585	1.5
Spruce	8,106	12,386	20,492	1.9
Cedar	7,528	154	7,682	0.7
Lodgepole pine	1,732	2,173	3,905	0.4
Hemlock	982	--	982	0.1
Cottonwood	357	23	380	1/
Total	773,650	325,290	1,098,940	100.0
Lath, M pieces	39,114	11,747	50,861	
Shingles, squares	30,869	10,573	41,442	

1/ Less than one tenth of one percent.

The 1940 cut of 1,098,940 M feet by Idaho and Montana mills producing 50 M feet and upward is 16.1 percent higher than the combined total output of these two states in 1939. In 1940, 85.2 percent of the aggregate cut was produced by 34 mills each cutting 5,000 M or over, and 14.8 percent by 345 mills of smaller capacity cutting from 50 M to 500 M during the year.

Pacific Northwest

Lumber Census. A considerable portion of Johnson's time was devoted to editing census schedules. Two weeks field work was required to pick up delinquent companies. To date 1938 acceptable schedules have been forwarded to Washington. There are a few companies still outstanding, but the census should be completed by the middle of June.

PAPER AND PULP

Northern Rocky Mountain

Wood-Pulp Possibilities. The report prepared in the Division of Forest Products pertaining to the possibilities of wood-pulp production in the Northern Rocky Mountain region was issued and has been in good demand since. The available supply of extra copies is almost exhausted. The city of Polson, Montana, is keenly interested in establishing a pulp mill in its vicinity, and several active meetings have been held there recently. Mr. DeGuere, a well-known pulp mill engineer and designer, is now examining the Polson site and making specific recommendations as to the opportunities at that place.

More tests of Engelmann spruce are needed in order to provide information on the subject of its suitability for wood pulp. In order that this information might be available at an early date, the Division of Forest Products sent two cords of spruce to the Forest Products Laboratory at Madison, Wisconsin, for testing. The Great Northern Railway Company cooperated by furnishing transportation free of charge between Montana and Minneapolis, its eastern terminal.

With Continental Europe under blockades and conditions in general upset by the war, inquiries regarding the suitability of local species for different uses have increased. Within the past week there have been three inquiries traceable to war conditions: one from a Parisian lumberman, now a refugee, who wants to become established in the lumber industry in this country; another from a firm in London, England, regarding possible supplies of veneer and plywood; and a third from a large maker of musical instruments who is looking for a local supply of wood suitable for sounding boards in pianos and violins.

TIMBER HARVESTING AND CONVERSION

Central States

Sylamore Logging and Milling Study. Preparation of additional tables comparing low grade hardwood trees cut on the experimental forest by size, condition, and desirability from the operator's point of view with log scale, grade, and amount and kind of defect continued. The variety of dimensions manufactured at the mill from hardwoods and pine permits mill tally only on the basis of actual products and grades, not on a straight lumber tally basis.

Pacific Northwest

General. The division made up a 2-window display for the First National Bank in Portland, centering around the theme "Utilization of secondary species and waste contributes to the stabilization of communities." Much favorable comment was received.

Dr. Brouse of the Madison Laboratory spent several days at the Station while en route home from a meeting of the Douglas-Fir Plywood Association. Johnson accompanied him on a 2-day field trip visiting plywood plants at Albany, Lebanon, and Sweet Home.

Johnson, together with several other members of the Station, attended the Klamath Falls meeting of the S.A.F. on May 23 and 24. At the Friday, May 23 meeting, Johnson presented log depletion data for Lake and Klamath Counties for the past 15 years.

Fir Mill Studies. Compilation of the data obtained at the Rosboro Lumber Company during the winter is well along towards the analysis stage.

Pine Mill Studies. Lodewick spent two weeks in eastern Oregon on a series of one-day studies in two ponderosa pine mills, one in Prineville and one in Lakeview. These were conducted in cooperation with the Divisions of Timber Management and State and Private Forestry. The objective is to test the reliability of one-day studies in estimating relative values of cut and reserve stands, in estimating the effect of defect in value, and in determining the suitability of any given comprehensive study for application to the timber and mill practice under consideration.

WOOD PRESERVATION

Northern Rocky Mountain

Early in May, Whitney and Rapraeger inspected four of the older pole lines and some experimental fences in eastern Montana, still included in our list of active service-test studies.

The pole inspections made included: (1) the Choteau-Ear Mountain telephone line, in which over 95 percent of the 449 butt-creosoted lodgepole pine stubs set in 1917 are free from decay after 24 years of service; (2) The Dillon-Rattlesnake Creek line, with 85 percent of

the lodgepole pine test poles still sound after 21 years of service; (3) the Gallatin Gateway-Squaw Creek telephone line, in which about 250 butt-creosoted lodgepole stubs set in 1924 contain no decay; and (4) the Bozeman-Flathead telephone line, in which about 200 lodgepole stubs treated with various forms of Anaconda Wood Preservative in 1929 and 1930 were partly alternated with 100 stubs of the same species treated with a 40 percent creosote-60 percent petroleum mixture.

The two fencepost installations inspected included posts of several species treated with a number of different preservatives and processes in cooperation with the U. S. Range Livestock Experiment Station, Miles City, Montana, in 1926, and also the Squaw Creek Ranger Station fence in the Gallatin Forest, where 198 tetrachlorphenol-petroleum treated lodgepole pine posts were set in 1935.

In bringing the inspection records of these and other installations up to date, it is planned to analyze the results of all our service tests (for both active and closed studies) and publish them in the form of a station paper.

FOREST AND RANGE INFLUENCES

FLOOD CONTROL SURVEYS

Allegheny

The February issue reported important differences due to cover types. If these types can be managed so as to improve measurably erosion-runoff conditions, then a U.S.D.A. remedial program might prove economically sound. A new table of coefficients for various forest cover types is being prepared for the Connecticut Survey and, if it stands up under further analysis, will probably provide a favorable cost-benefit ratio. If it does, then the negative Allegheny result will be open to serious questions unless it is based wholly on the dissimilar damage conditions - the Connecticut having widespread damage on all tributaries and the Allegheny having nearly all its damage concentrated in the Pittsburgh area.

Appalachian

Preliminary Examinations and Advance Studies. During May several members of the Station's flood control personnel have collaborated with the Bureau of Agricultural Economics on a comprehensive preliminary study of the Neuse Watershed in North Carolina. Under the new concept of more detailed preliminary examinations, methods approaching those used on surveys are being employed in an effort to arrive at an approximation of probable flood reductions and benefits from a proposed program.

Results of the Station's cooperative effort with the Geological Survey, Weather Bureau, and Army Engineers in obtaining rainfall and run-off information from the August 1940 floods will soon be available. Peak discharge measurements at about seventy localities have been computed and checked by the Geological Survey. A series of isohyetal maps by varying time intervals has also been completed by the U. S. Engineer Office in Norfolk, Virginia, and will shortly be available. These maps will give the first comprehensive and most complete picture available of the rainfall causing the August floods. The Station has materially contributed to the collection of basic data for both the rainfall and run-off study.

Watershed Surveys. During the past two months, work on the Potomac Flood Control Survey has been devoted almost entirely to completing the evaluation and writing the report. The field survey is scheduled for completion on June 7 and present progress indicates that this deadline will be met by the all-out effort of the Survey staff.

Station flood control personnel are assisting the Soil Conservation Service on the revision of the Coosa Survey, scheduled for completion on June 15, when the field report is due.

California

Cooperative Flood Control Work

Russian River Preliminary Report. The basic data collected during the preliminary Flood Control Survey of the Russian River drainage were used in the analysis of the hydrograph of an observed approximate 50-year storm that occurred in February 1940. The purpose of the analysis was to estimate the effects of improved land use or regulation upon future flood peaks. A new approach was used in the analysis in that the hydrograph was broken down and resynthesized on the basis of the influences of individual in-watershed factors,

such as evaporation, interception, infiltration capacity, and soil storage capacity. The Northfork data were drawn upon to supply measures of the magnitude of the effects of changes in land use upon the in-watershed factors and to estimate various run-off time relations. The results of the analysis indicated that the flood peak of the 50-year storm could be reduced approximately 20 percent through improved land use. For smaller storms much greater reductions in flood peaks would be expected.

Central States

Wabash Preliminary Examination. An advance statement prepared for the F.C.C.C. on the Wabash was submitted on April 1. A program of surveys was outlined covering approximately half of the watershed and listing in priority the West Fork of the White, the Little Wabash, the East Fork of the White and the Upper Wabash. Both the West and East Forks of the White River are largely in old Illinoian glaciation or unglaciated territory and areas in which extensive public ownership of forest land will be desirable.

The complete Intensified P. E. report on the Wabash is in rough draft and will probably be submitted to Washington during June. Wood has carried practically all the Forest Service load on this report.

Cumberland River Preliminary Examination. Field work by all three agencies has been completed and the analysis of the data well advanced. Certain sections of the first draft have been prepared and all sections are expected to be in by June 15. A first draft of the report will be complete by June 30.

Correspondence with the National Resources Board indicates that they are awaiting with interest the completion of this report since it will be used with a similar report by the Corps of Engineers as the basis for an integrated report on the Cumberland similar to that prepared for the Red River of the North. Cummings and Marshall together with Sturgeon, Kramer and Lye have given full time to the Cumberland. Wood and Day have also given some time to this examination.

Lake States

As a result of the reorganization of the Flood Control program, the Station's share in this work has been greatly curtailed.

On April 15, Scholz was assigned to the Soil Conservation Service for completion of the Whitewater detailed survey and assistance on the Little Sioux survey. Blythe was detailed to the BAE for preliminary examinations, and Bates was assigned to complete work on the hydrology of the Whitewater.

INFLUENCE OF NATURAL VEGETATION ON STREAMFLOW

Appalachian

New 15-foot Weir. A 15-foot modified C^1A weir is completed at the Bent Creek Experimental Forest.

The results of the model tests made at the National Hydraulics Laboratory are incorporated in the design of this control. The main design features are a 15-foot flow section, vertical walls with 30" entrance radii, a six-foot apron and facilities for comparing a static tube and the conventional open end pipe for measuring heads.

Six feet of the ogee section were constructed using the available alloy forms, and the remaining nine feet with open concrete pour and templates. The latter method of construction, although more difficult, appeared to give a generally better result. Forms for constructing the vertical walls, using Masonite pressedwood bent to a 30" radius on a barrel-frame backing are now available.

Since this weir is the first of its kind a brief construction report giving the design details and construction procedures will be prepared.

California

Watercycle and Soil Studies. The 1940-41 rainy season was characterized by prolonged rainfall that occurred for the most part at low intensities. There was very little snow below 3,000-foot elevations. The rainfall recorded at the several field stations as of May 15 was: Northfork 46.12 inches, Bass Lake 60.93 inches, and Berkeley 42.62 inches. This was in excess of the seasonal normal by approximately 13, 11, and 15 inches, respectively.

The results of the interception studies at Bass Lake and Northfork, as determined from an analysis of some of the season's storms, permit several interesting conclusions. The results of the Ceanothus cuneatus interception study at Northfork indicate that the interception loss is confined almost entirely to the amount of rain required for the initial wetting of the brush cover. The evaporation losses during actual periods of precipitation are extremely small.

The ponderosa-pine interception study at Bass Lake indicates that there was little or no relation between the amount of stemflow and tree diameter for the storms of 1940-41. Such factors as exposure of the tree with respect to wind direction during a storm and the position and height of the tree with respect to surrounding trees apparently influenced stemflow more than the diameter. This is in contrast to the findings in the Northfork Aesculus californica interception study where a direct correlation between stem diameter and stemflow has been found.

San Dimas Civilian Public Service Camp. Several months ago negotiations were started with representatives of the American Friends' Service Committee to establish a camp on the San Dimas Forest for conscientious objectors to military service. After judging the watershed-management research program on the San Dimas area to be of national importance, the Selective Service System approved the San Dimas Camp. Dr. Edwin B. Newman of Swathmore College, Pennsylvania, was designated Director of the camp by the American Friends' Service Committee. This organization will be responsible for the subsistence of the men, their health, recreation, etc., while the Station will supervise the work program under a plan similar to the operation of a CCC Camp. The camp, which is located at our Tanbark Flat field headquarters, will have a capacity of at least 100 men who will be assigned from several western states for a year of service. It is expected that this group will be of material assistance in the operation and maintenance of the San Dimas Forest. At this writing the first contingent of 16 men has just arrived in camp.

Rainfall-Streamflow. Rainfall on the San Dimas Forest during the past winter season has been the highest experienced during the past 8 years of operation. Seasonal averages to date for the several large watersheds are as follows:

Watershed	Rainfall, inches	Altitudinal range, feet
I Wolfskill	48.80	1700 - 5200
II Fern	55.10	2600 - 5500
III Upper East Fork	53.96	2600 - 5200
IV East Fork	53.73	1900 - 5500
V North Fork	48.62	1900 - 4500
VI Main Fork	50.71	1600 - 5500
VII West Fork	47.67	1600 - 3100
VIII Bell	48.25	1900 - 3500
IX Volfe	50.72	1900 - 3500
X Monroe	50.16	1800 - 3400
Big Dalton	48.62	1700 - 3500
San Dimas	49.65	1500 - 5500
Entire Forest	49.39	1500 - 5500
Highest gage #51	64.32	
Located on 5100-foot contour trail in Fern Canyon		
Lowest gage #558	38.24	
Located on ridge above San Dimas reservoir on east side of canyon		

Average rainfall on the Forest was compared with that occurring in Glendora and found to have the ratio of 1.27 to 1. The 60-year record of rainfall at Glendora was used to prepare a frequency curve for total seasonal rainfall on the Forest. From this curve it was ascertained that this season's rainfall of 49.39 inches may be expected to occur only once in 50 years.

As the result of this exceptionally large amount of precipitation, all streams are flowing much higher than normal for this time of year. For example, the following table gives the flow recorded on May 18 at Flume X, watershed area 864 acres, for each year since the start of record.

Year	Flow (Cu. ft./sec.)	Average rainfall Inches
1935	.30	33.70
1936	.12	25.73
1937	.40	41.30
1938	.47	41.14
1939	.12	19.70
1940	.08	26.41
1941	1.08	50.16

Vegetation. Another influence of the abundant rains of the past season is evident in the marked increase in growth of the herbaceous species compared to previous years of observation. Vegetation on the nine 1/40 acre Tanbark run-off plots has recently been remapped 100 percent. The following tabular comparison is based upon data from three of the plots which have been summarized to date.

Year	Herbaceous cover density, percent	Annual rainfall Inches
1937	23.0	41.70
1938	21.6	40.53
1939	12.9	20.20
1941	28.6	46.65

Intermountain

Streamflow Installations. Studies of surface run-off and soil erosion on watersheds A and B at Great Basin Branch Station near Ephraim, Utah have been expanded during the past year as a result of construction of 6 new stream gaging stations on Ephraim Creek and its tributaries. In addition to these, 3 additional stream flow measuring stations have been established to determine the flow into Ephraim Creek from transmountain diversions from the Colorado drainage so that proper corrections may be applied for diverted water.

The type of stream gaging station constructed consists of a precisely constructed rubble masonry control section with V-shaped bottom, and stilling well. These stations permit the measurements of very small flows such as 5 to 10 g.p.m. and provide for passage of debris-laden flash flow. Development of rating curves is now in progress.

The streamflow being measured is from watersheds at high elevations where much of the annual recharge occurs, where soil and vegetation have been subjected to the most intensive use, and where flash run-off from torrential summer rainstorms is not uncommon -- a highly desirable combination of conditions. The nature of the topography also permits construction of limited upstream water control structures which ultimately may give needed information as to their influence on stream flow, especially on its seasonal distribution.

Although stream gaging stations were not constructed until the summer of 1940, temporary stations established in March permitted an intensive study of snow melting -- stream flow relations. This has been greatly intensified as a result of the more accurate stream flow control.

Lake States

A special study of infiltration rates under natural and artificial rainfall is being conducted at LaCrosse. Small plots used with the infiltrometer have been established on some of the experimental areas. Infiltration tests with artificial rainfall are being made at regular intervals, several times weekly. Also, the runoff from these small infiltrometer plots is measured whenever natural rainfall occurs. Infiltration rates will be calculated for these storms and compared with the rates obtained from the artificial applications of rain and also with the rates obtained from the larger areas on which the small plots are located.

It is hoped that the results will explain some of the progressive changes in infiltration rates and permit the relations between rates under natural and artificial conditions and on large and small areas to be worked out.

Rocky Mountain

Storage of Snow Influenced by Cutting of Mature Lodgepole Pine. In the bi-monthly report for April (page 69), preliminary data were given on snow storage in a group of 20 methods-of-cutting plots at the Fraser Experimental Forest. These data presented, which are the results of the first survey on March 16-18, 1941, showed a pronounced effect of the intensity of timber cutting on snow storage, with the volume of stored water in roughly linear proportion to the intensity of cutting.

Final data on all surveys (table next page) support these preliminary findings, and show that the initial advantage of greater water volumes on the cut-over plots was not overcome by excessive melting rates. Actually the snow lasted a day longer on the plots subjected to the two heaviest cuttings than on the other areas.

Snow storage as affected by cutting of mature lodgepole pine, Fraser Experimental Forest, 1941

Date of survey	Reserve stand, board feet per acre				
	Virgin 11,890	6,000	4,000	2,000	0
1941	Inches	Inches	Inches	Inches	Inches
3/18	5.26	6.31	7.06	7.36	7.75
3/25	5.49	6.78	7.30	7.65	7.81
4/1	5.50	6.72	7.42	8.16	8.01
4/8	6.88	8.09	8.86	9.29	9.37
4/15	6.86	8.28	8.90	9.34	9.40
4/22	7.80	9.21	9.65	10.30	10.54
4/29	7.05	8.44	8.84	9.73	9.47
5/6	5.14	6.29	6.56	7.25	6.78
5/12	1.96	1.83	1.99	3.10	2.31
5/20	0.07	0.11	0.08	0.28	0.26
5/27	--	--	--	--	--
Total	52.01	62.06	66.66	72.46	71.70

The integrated influence of timber cutting on both initial storage and melting rate is shown by "storage duration indices": the summed values of all surveys (last line in the table). Judging by these indices, the plots with no commercial timber and those containing 2000 board feet per acre were about equal in their effect on snow storage; the virgin plots occupied the lowest place; and the other two treatments gave values falling in a straight line between the two extremes.

Influence of Grazing on Watersheds; Manitou Experimental Forest. The allocation of cattle on June 2 to six experimental pastures marked the beginning of an intensive study designed to determine the effect of grazing intensity on watershed relations and other factors in the Front Range of the Rocky Mountains.

As a preliminary step, all six pastures (of 250-300 acres) will be subjected to approximately equal intensities of grazing by yearling heifers for a period of two or more years. During this time measurements will be taken of cattle weight gains, and of factors such as infiltration capacity, current erosion rates, forage production, plant cover density, and associated variables.

After adequate calibration data have been obtained on each of these factors, grazing rates will be changed so that two pastures will be heavily grazed, two grazed lightly, and two will remain at the normal intensity of treatment. Subsequent periodic measurements of all factors will be compared with results obtained during the calibration period.

Southwestern

Southwest Experiences Unusual Winter Season. The winter period, October 1, 1940, to May 31, 1941, will doubtless stand out for many years to come as a most exceptional period of precipitation and stream flow. On the upper Parker Creek watershed, an area of 700 acres well covered by grass, brush, and pine-fir timber, average precipitation for six winter periods prior to October 1, 1940, was 18.72 inches as compared to slightly more than 40.00 inches already recorded for the past winter. Winter stream flow on this same area will be approximately equivalent to a depth of 18 inches over the watershed area, more than one-half the total of 30.47 inches yielded during the preceding six winter periods.

Although flow was high following the 5-inch rainfall of March 11 to 15, which fell on ground soaked by previous rains, natural stream channels carried it without damage and relatively little silt was carried by the stream. It is rather remarkable that so much water could move through the soil and be delivered to streams with so slight a disturbance to soil or litter cover on slopes where the average gradient is 60 percent or more. This degree of soil stability is possible only where full development of all components, i.e. herbs, grasses, trees, and shrubs, of the vegetation cover is permitted. On this particular area herbaceous vegetation has improved greatly since closure to livestock use in 1932 and has regained control on areas of former break-down.

On the 1,087-acre Workman Creek watershed at a general elevation of 7,000 feet, 45 inches of precipitation, mostly in the form of snow, was measured. So far a much lower percentage of water yield has been recorded on this area. The unusually heavy winter precipitation should result in a higher base flow during the spring and fall dry periods of this year. Flow during the dry periods of the last 2 years has dropped to a fairly low level.

Although this watershed is covered with a heavy stand of pine-fir timber, herbaceous vegetation has been greatly reduced by overutilization.

This condition results in some erosion of topsoils and increased height of flood peaks during periods of rapid snow melt or fairly intense rainfall. It is evident from observations on stream behavior and lysimeter records that silting and flood peaks can be reduced through the restoration of herbaceous cover. On casual inspection and without careful comparison of protected and nonprotected areas and stream courses, results of this deterioration would probably not be noticed and if observed might be considered as inconsequential. However, topsoil moving from all parts of the Salt River watershed has resulted in deposition of silt in Roosevelt Reservoir at an average rate of 4,000 acre-feet per annum. Even though this rate of silting is probably only one-fourth as great as that of other large reservoirs in the Southwest, as for example Elephant Butte Reservoir in New Mexico, the tremendous significance of this silt movement may be realized if we consider that a reduction of silting by one-half would add 300 years to the effective life of the five reservoirs on the Salt River system, constructed at a cost of $15,000,000.

The need for every bit of available storage capacity was demonstrated this spring when it became necessary to release large quantities of water from lower reservoirs in order to recapture storage capacity after Roosevelt Lake filled during the storm of March 11 to 15. By the release of water from the lower reservoirs before heavy flow from upper Salt River reached them, flow through the Salt River Valley was regulated and no serious damage resulted even though the river ran bank full for several weeks.

Rainfall at lower elevations on the watershed during this exceptional winter period was also far above normal, as shown by the comparison of catch of the past season with average for preceding winter periods between 1931 and 1940, given in table 1. According to these measuremonts, surface run-off was the greatest ever recorded in any one season. There was probably considerable seepage flow which was not intercepted since the installations were designed for measurement of surface run-off only. Several inches of percolation from lysimeters $3\frac{1}{2}$ feet in depth indicated deep penetration of seepage water and contribution to stream flow via the underground route. More than one-half of the eroded material measured during the winter period resulted from two storms in November and December which supplied only 18 percent of the total rainfall. In the two storms, rain intensities during brief periods compared favorably with average high intensities for summer storms.

Table 1.– Comparison of rainfall, eroded material, and surface run-off of winter of 1940-41 with that of preceding summer and winter periods on 1/2-acre drainage in a granitic soil-type area

Period	Rainfall inches	Surface run-off cu. ft. per acre	Eroded material cu. ft. per acre	Percent water recovered as run-off	Percent eroded material in total run-off
Summer (Ave. of 10 periods)	6.43	1,623.9	402.5	7.0	19.9
Winter (Ave. of 9 periods)	8.52	296.5	40.3	1.0	12.0
Winter 1940-41	23.53	5,483.7	359.4	6.4	6.2

STABILIZATION OF SOILS

Appalachian

An extensive roadbank naturalization program is being carried out by the CCC camps on Cumberland National Forest under consultation with the Appalachian Station. This project has just been reviewed in the field. The general method used is a brush and litter mulch. The most difficult single problem met with in the field is how to instruct the local foremen to modify the technique to suit individual sites. It is difficult for the foreman on the job to determine to what extent the naturalization work should be completed the first time and to what extent a minimum amount of work should be done on the first go-round and later followed with patching up failing areas. The solution of this problem is largely local, depending upon the number of man-days available when the first work is being done and the expected amount of labor for future maintenance.

Extensive direct seeding without mulching has been entirely unsuccessful. The main difficulty appears to be one of instability of soil on the steep slopes seeded.

Plans are now being made to use roadside mowings during the late summer. All material cut along the roadside will be placed on the banks as a staked weed mulch at once, or will be cured and piled for later use.

RANGE RESEARCH

GRAZING MANAGEMENT

Appalachian

Forest Grazing

Grazing Capacity and Cattle Diet. Reed pastures grazed in the fall and early winter, after the cessation of summer growth, have about half the grazing capacity of those grazed during the spring and summer. This statement is based on a comparison of a 96-acre pasture grazed from November 19 to January 20, to three pastures, totaling 185 acres, grazed from May 15 to November 19. The pasture grazed in the fall and early winter furnished 36 cow-days' grazing per acre, whereas those used during the spring and summer provided 84 cow-days. However, approximately 25 percent of the area in the 96-acre pasture and 10 percent of that of the 185 acres were not covered by reeds. When grazing capacity is based on actual acreage of reeds, the first pasture furnished 46 cow-days' grazing per acre and the latter 92 cow-days. The pasture used during the fall and winter was heavily utilized by the end of the season. Two of the pastures grazed at the end of the season were very heavily utilized and the other was used moderately.

Heavy utilization of tall reeds (those above 6 feet in height) in the fall and early winter does not injure them as it does in the spring. In fact, fairly heavy utilization of such stands at this season of the year appears, on preliminary observations at least, to increase the vigor of a stand. Through heavy grazing and removal of the reed leaves more light is allowed to reach the new shoots and lower leaves that come out the next spring, and as a result they grow more vigorously. In addition, any dead reed stalks are broken by the cattle and disposed of more quickly than they would be otherwise.

Observations of forage preference by cattle were made periodically during the time they were in the 96-acre pasture. When the cattle were first put in they browsed very heavily on the few groundsel-trees (Baccharis halimifolia) there, and its preference rating, under the conditions here, was very high. Similarly, other species thought not to be very palatable, including a loblolly pine, were readily taken. Observations made elsewhere in the Coastal Plain at this season and under varied conditions show that several of these species are not nearly as palatable as indicated in this 96-acre pasture where reeds make up practically all the cover and there is but little variety of feed. These observations show, or indicate, three things: (1) that cattle prefer a mixed diet, (2) that in studying forage preference of animals the conditions under

which they feed must be given careful consideration, and (3) that any conclusions about forage preference should be based on observations made in several places and under varied conditions.

California

Pine Range

Winter Utilization of Bitterbrush by Deer. Some new findings are already available on the vexing problem of bitterbrush management, from plots established last year by Hormay of the Station and Douthitt of the Regional Office.

Remeasurement of plots on the Modoc Forest early in May showed that 52 percent of last year's twig growth on bitterbrush had been removed by deer during the winter. Stated in another way --Of the growth remaining on the plants at the end of the livestock grazing season last October, 64 percent was utilized by deer during the winter. These figures are interesting because they represent a serious effort to obtain concrete measurements on bitterbrush utilization, and because they differentiate between use by livestock and by deer.

Bitterbrush is the most important browse species in the Eastside region of California. It covers large areas and is utilized by game animals and other forms of wildlife as well as by domestic livestock. Its vigor is seriously reduced in many localities and in others it is slowly dying out. Heavy grazing without question is contributing to this condition in many cases.

To what extent deer compared to livestock are responsible for the deteriorated condition of bitterbrush is something that has to be known before appropriate steps can be taken to rejuvenate and increase the productive capacity of bitterbrush ranges. The relative use of this browse plant by livestock and by deer varies from locality to locality and gives rise to different problems.

The present measurements were made in the vicinity of Badger Well on the Modoc Forest, where livestock and a light population of resident deer graze the range through the summer and a heavy population of migrant deer graze during the winter. Five plots 2 chains long and 3.3 feet wide were laid out in relatively lightly used bitterbrush stands at the end of the livestock grazing season last fall, with the view of testing the practicability of measuring bitterbrush utilization by deer during the winter. The average diameter, the average twig growth, and the percent utilization were recorded for each plant on the plots. The average use, representing summer grazing by livestock, was 19 percent. The annual winter migration of deer onto the Modoc Forest from Oregon subjected the bitterbrush to deer

grazing until this spring, when the deer again moved back into Oregon. Remeasurements in May, before livestock came onto the Forest, showed that the utilization of the plants had increased from 19 to 71 percent. In other words, 52 percent of last year's growth — or 64 percent of the available growth — was utilized by deer. The following tabulation summarizes the data.

Plot No.	No. of plants	Average twig growth 1940 (inches)	Percent utilization Oct. 1940	May 1941	Difference
1	24	5.9	23	49	26
2	32	5.3	36	83	47
3	31	4.9	5	79	74
4	22	6.4	19	80	61
5	53	4.5	10	59	49
	Average	5.2	19	71	52

100-19 = 81 percent = percent growth available to deer.

$\frac{52}{81}$ = 64 percent = percent available growth utilized by deer

It should be remembered that these figures do not represent the prevailing condition around Badger Well because the plots were purposely placed in areas where livestock grazing had been light during the previous summer and where utilization by deer therefore had a better chance of being detected. A representative sample would have shown considerably more than 19 percent use by livestock and a relatively lighter use by deer.

This work revealed that the degree of utilization was not related to the size of the plants. Large and small plants within reach of livestock and deer were utilized to about the same degree. Uneven use was also characteristic. Some plants were uniformly closely cropped and others were only partly utilized. Heavily and lightly grazed plants frequently stood side by side. Often part of the same shrub was very closely cropped and the remainder was left untouched. With heavier stocking of course nearly all growth might have been utilized.

It was observed with distinct interest that the plot work served to sharpen observations on bitterbrush utilization over a wider area. The degree of utilization on adjoining areas stood out much more clearly after the "training period" on the plots.

The present study indicates that winter utilization of bitterbrush by deer may be heavy and may be a very important factor for consideration in the management of this browse plant in some localities.

The work showed that the method used in arriving at utilization estimates is sensitive enough for the purpose and can be carried out practically in the field even by one man. Sampling, to determine actual use of bitterbrush by livestock and by deer around Badger Well, will be carried out this fall and next spring.

Foothill Range

Field Day. Around 250 stockmen and interested persons attended a field day on May 20 at the San Joaquin Experimental Range, where problems of foothill range management in central California are being studied cooperatively by several agencies. After a fine talk on the general range-livestock situation by Dr. Schneider of the Agricultural Extension Service, University of California, the rest of the morning was devoted to an explanation of the forage studies being conducted by the Forest Service, with emphasis on "grass" — particularly the effects on the forage of different intensities of grazing, and reseeding problems on annual-type ranges. A visit was made to the forage plant nursery, where many species are being tested for their adaptability to the prevailing climate. In the afternoon the Animal Husbandry Division of the University took over, with a discussion of the effect on the cattle of different rates of stocking, inspections of the University's herd, and summarization of data on supplemental feeding. The wildlife studies — of range rodents and associated wildlife by the Fish and Wildlife Service, and of quail management carried on cooperatively by the Forest Service, Fish and Wildlife Service, Division of Zoology of the University, and California Division of Fish and Game — as well as other phases of the forage and cattle studies, will be featured at future field days.

Intermountain

Summer Range

Clipping Plots as a Measure of Yearly Forage Production. To determine forage production from year to year, rod-square plots inside areas closed to grazing have been clipped annually near the Great Basin Branch Station. Inspection of the data from individual plots shows that their response is by no means uniform, and the question arises as to how accurately they reflect actual fluctuations in production.

Three pairs of plots, selected as being the most comparable ones available, may be used by way of illustration:

(a) Plots 67 and 66, 2½ miles apart, at an elevation of about 10,000 feet; 16 years of record.

(b) Plots 68 and 77, less than 100 feet apart, at an elevation of about 9,000 feet; 11 years of record.

(c) Plots 64 and 65, less than 100 feet apart, at an elevation of 8,850 feet; 8 years of record.

The plots of the first pair are presumably subject to essentially similar climatic conditions, although they lie in different plant associations. The members of the second and third pairs exist under almost identical conditions. Thus, one would expect a close relationship between the yields of the members of each pair.

As shown in the following table, however, the correlations are surprisingly low:

Plot No.	67	66	68	77	64	65
Years of record	1925 - 1940		1930 - 1940		1924 - 1931	
Correlation coefficient	.30		.68		.69	
Probability	.25		.03		.07	
Std. error of est., grams	1,317		1,387		1,102	
Mean yield, grams	2,729	2,671	2,226	3,738	3,442	3,564
Highest yield, grams	4,589	6,818	3,551	6,414	5,447	6,575
Lowest yield, grams	1,515	704	522	866	1,568	1,906

The coefficient for the first pair is, in fact, not even significant, while the coefficients for the second and third pairs, of .68 and .69, show that less than 30 percent of the variation is shared by both members.

Something of the magnitude of the discrepancy is given by the value of the standard errors of estimate, running over 1,000 grams in each instance. This may be interpreted to mean that if a series of observed values for plot 67, for example, were to be used to predict corresponding values for plot 66, the actual values could be expected not to lie outside a range of 2,634 grams more than 32 percent of the time, and not to fall outside a range of 5,268 grams more than 5 percent of the time. These are indeed wide margins of error, for the spread between one standard deviation on each side of the regression line is roughly equal to the mean yield, and the two standard deviation (95 percent) range of error includes practically all yields so far experienced.

Nonsignificance of correlation for the first pair of plots, which are at about the same elevation but separated 2½ miles, suggests a danger in attempting to use widely separated plots to describe forage production. This danger is that the yields from plots in different plant associations may well constitute different populations statistically. Hence unless properly weighted, they should not be averaged, for they may give a misleading conception of total forage production. The error when considering relative yields will probably tend to lessen the true magnitude of the fluctuations from year to year.

The lack of close correlations may be explained by changes in vegetal composition, different effects as the result of the clipping, denudation by gopher workings, utilization by rabbits and rodents, imperfections in the technic of clipping and weighing, and so on. These factors, however, are largely inseparable from the method. Some more extensive method, such as the method of weight-estimate survey, is clearly desirable.

Pacific Northwest

Utilization surveys made on the Starkey Experimental Range during 1939 and 1940 have now been analyzed. These surveys consisted of percentage utilization estimates on 100 square-foot, circular plots located over the area in a grid pattern at an intensity of 20 plots per section. On each plot percentage utilization was estimated on each species using the ocular-estimate-by-plot method.

One of the striking things shown by the surveys was the consistency with which the cattle grazed the different species making up the forage on the range during the two years. Most of the important species were grazed to approximately the same degree in 1939 as they were in 1940 (table 1). For example, the average utilization of Sandberg bluegrass (Poa secunda), the most abundant species on the area, was 32.4 percent in 1939 and 30.4 percent in 1940. Bluebunch wheatgrass (Agropyron spicatum) was utilized 69.5 percent in 1939 and 62.0 percent in 1940, and pinegrass (Calamagrostis rubescens), an important species in timbered areas, was utilized 11.9 percent in 1939 and 9.5 percent in 1940.

Another outstanding characteristic of cattle grazing shown by the surveys was that grasses and grasslike plants made up most of the forage obtained from the range. In the grassland types 97.0 percent of the forage was obtained from grasses, 92.5 percent from four species, Sandberg bluegrass, bluebunch wheatgrass, onespike oatgrass (Danthonia unispicata) and Idaho fescue (Festuca idahoensis). In the open timber

type where these same species predominate, 95.2 percent of the forage was derived from grasses and grasslike plants, 92.9 percent from these same four species together with elk sedge (Carex geyeri). Even under the denser timber where the vegetation is composed of, on the average, 36.7 percent grasses and sedges, 43.9 percent weeds, and 19.4 percent browse species, 87.6 percent of the forage was derived from the grasses and sedges, 33.0 percent being from elk sedge, 22.7 percent from Sandberg bluegrass, and 9.8 percent from pinegrass. On this type, weeds made up 7.7 percent of the forage and browse 4.7.

Table 1.— Percent utilization of important species on the Starkey Experimental Range as determined by two utilization surveys.

Species	1939 Survey		1940 Survey	
	No. of plots	Percent utilization	No. of plots	Percent utilization
Grasses				
Agropyron spicatum	183	69.5	66	62.0
Bromus tectorum	42	3.1	35	4.1
Calamagrostis rubescens	177	11.9	192	9.5
Carex geyeri	305	30.1	218	39.8
Danthonia unispicata	76	56.5	47	54.0
Festuca idahoensis	154	68.4	83	48.0
Koelaria cristata	218	22.5	92	36.3
Poa secunda	371	32.4	307	30.4
Weeds				
Achillea lanulosa	380	1.6	303	3.3
Antennaria spp.	183	2.0	213	0.0
Arnica cordifolia	158	0.0	55	0.0
Drymacallis glandulosa	2	0.0	36	3.8
Eriogonum heracleoides	45	1.6	68	4.6
Grindelia squarrosa	126	1.5	113	0.4
Hieracium scouleri	134	2.3	90	10.5
Lupinus spp.(Largely L.sulphureus)	209	1.2	141	5.2
Pentstemon spp.(Largely P.procerus)	11	20.0	40	10.6
Potentilla spp.(Largely P.gracilis)	16	7.5	8	16.2
Sieversia ciliata	140	2.4	66	0.6
Sidalcea oregana	13	5.0	2	30.0
Wyethia amplexicaulis	41	0.7	2	12.5
Shrubs				
Ribes spp. (Largely R. cereum)	18	0.0	2	12.5
Rosa spp.	38	7.9	61	14.6
Symphoricarpus albus	180	5.8	152	14.8
Spiraea lucida	76	0.3	123	1.2

In 1940 there was a slightly heavier use of many of the species which remain green throughout the summer than occurred in 1939. For example, elk sedge and most of the shrubs were grazed heavier in 1940 than in 1939. On the other hand, the species which dry up in the early summer — bluebunch wheatgrass, Sandberg bluegrass, Idaho fescue, and pinegrass —were used slightly less in 1940 than in 1939. This is thought to result from the longer dry period during the summer months in 1940 which caused the cattle to spend less time in open types and a greater proportion of the time in the timbered types.

Rocky Mountain

Chemical Control of Orange Sneezeweed. Tests to eradicate orange sneezeweed on small plots have included the application of chemical herbicides to the soil. Dry granular borax and an 8 to 1 mixture of borax-sodium-chlorate were broadcast by hand over heavily infested plots at rates of 300,600, and 900 pounds per acre during June, August, and September of 1939.

Results to date indicate that the mixture of borax-sodium-chlorate was in all cases more effective as a herbicide than pure borax. Even the 300-pound rate of application of the mixed chemicals was severe enough to destroy most of the vegetation. It was found, however, that the mixture killed all vegetation whereas pure borax killed sneezeweed and certain other shallow-rooted weeds, but was not very harmful to grasses.

Borax at the 300- and 600-pound rates had a fertilizer effect on grasses, but destroyed most of the sneezeweed. For example, on a plot which received borax at the rate of 600 pounds per acre in June 1939, four kinds of grasses were measured in 1940 and found to be from 30 to 50 percent taller than the same grasses on adjacent untreated areas. By comparison with nearby plots from which sneezeweed had been grubbed, it was evident that the increased vigor of the grasses on the borax plot was caused by factors other than reduced competition.

Regardless of the amount or kind of chemical applied, the reduction of sneezeweed was much greater if the application was made in September than in June or August. Apparently, soil moisture conditions following the September treatments were more favorable for proper movement of the dissolved salts.

Eradication costs are too high for a widespread control program, as application of 300 pounds of borax costs from $8.00 to $10.00 per acre. Further tests may reveal a less expensive method such as a different mixture of borax and sodium chlorate.

Southwestern

Plant Control - Burroweed. In July 1935 a study of perennial grass transplant survival and competition of these plants with burroweeds was initiated on the Santa Rita Experimental Range. Five species of native perennial grasses were used in the study, namely, Muhlenbergia porteri, Aristida divaricata, Trichachne californica, Heteropogon contortus, and Sporobolus airoides. The plants were transplanted within two areas, one of which is protected from rabbits and livestock year long and the other fenced against livestock only. Each plant was set out immediately adjacent to a mature burroweed plant, the location of which was marked with a wooden stake. Observations as to the percent survival of the transplants and the effect of the competition of these plants on the burroweed were made on the dates indicated in tables 1 and 2.

Data on the numbers of plants set out and the survival of the various species tested are summarized in table 1.

Table 1.— Survival of perennial grasses transplanted adjacent to burroweed plants

Degree of Protection	Species	Number planted July 9, 1935	Number alive Oct.10, 1935	Percentage survival Oct. 10, 1935	Number alive Aug.3, 1939	Percentage survival Aug. 3, 1939
Year-long protection from rabbits and livestock	Mpo	189	1	.5	1	.5
	Adi	248	27	10.9	22	8.9
	Tca	188	130	69.1	94	50.0
	Hco	195	11	5.6	6	3.1
	Sai	196	31	15.8	12	6.1
	Total	1,016	200	19.7	135	13.3
Year-long protection from livestock	Mpo	342	7	2.0	1	.3
	Adi	348	25	7.2	23	6.6
	Tca	509	257	50.5	215	42.2
	Hco	317	29	9.1	11	3.5
	Sai	436	89	20.4	30	6.9
	Total	1,952	407	20.8	280	14.3
Total of all species in both areas		2,968	607	20.4	415	14.0

Examination of the contents of this table reveals that:

1. Cottontop (Trichachne californica) from the standpoint of percent survival was superior to the other species tested.

2. There was no significant difference in percent survival between the livestock and rodent exclosures. This is probably due to effective rodent control prior to the initiation of the study, which materially reduced rodent pressure within the cattle exclosure.

3. Percent survival of the total of all species on both areas declined from 20.4 percent as observed October 10, 1935, to 14.0 percent on August 3, 1939.

Competition between the surviving grass transplants and adjacent burroweed plants was observed in the years following initiation of the study. Data relative to the subsequent death of burroweed plants are presented in table 2. When first observed, October 18, 1937, there was no significant difference between the percent death

Table 2.— Death of burroweed plants adjacent to surviving grass transplants.

Degree of Protection	Species	Observed October 18, 1937			Observed August 3, 1939		
		Burroweed alive	Burroweed dead	Percent dead	Burroweed alive	Burroweed dead	Percent dead
Year-long protection from rabbits and livestock	Mpo	1	0	0.0	0	1	100.0
	Adi	23	0	0.0	8	14	63.6
	Tca	96	10	9.4	60	34	36.2
	Hco	5	0	0.0	3	3	50.0
	Sai	13	3	18.8	7	5	41.7
	Total	138	13	8.6	78	57	42.2
Year-long protection from livestock	Mpo	7	0	0.0	0	1	100.0
	Adi	15	10	40.0	6	17	73.9
	Tca	179	42	19.0	116	99	46.0
	Hco	13	2	13.3	5	6	54.5
	Sai	60	10	14.3	11	19	63.3
	Total	274	64	18.9	138	142	50.7
Total of all species in both areas		412	77	15.7	216	199	47.9
Check burroweed plants (no live grass)		128	21	14.1	118	62	34.4

rate of burroweed plants with adjacent living grass clumps (15.7 percent) and burroweed plants without this immediate competition (14.1 percent). However, 2 years later, August 3, 1939, competition from the grasses had become more evident being 47.9 percent as compared with 34.4-percent death loss of burroweed plants without competition from grass transplants. This represented a difference of 13.5 percent or an accelerated death loss of 39.2 percent. The significance of these differences was tested by the usual Chi Square test for a 2x2 table as follows:

	Burroweed (alive)	Burroweed (dead)	
Plants with adjacent grass transplants	216	199	415
Plants without adjacent grass transplants	118	62	180
	334	261	595

$$\text{Chi Square} = \frac{(ad-bc)^2 (a+b+c+d)}{(a+b)(c+d)(a+c)(b+d)}$$

$$= \frac{[(216)(62)-(118)(199)]^2 \quad 595}{(334)(261)(180)(415)} = 9.302$$

Since this value of Chi Square (9.302) lies between the 1-percent and .1-percent point, the competition offered to burroweed plants by the various grasses was effective, and there is a significant difference between the two mortality rates of 47.9 percent and 34.4 percent.

Utilization Standards. Preliminary analysis of part of the data obtained during the fall of 1940 on the initial phase of the Utilization Standards project has been completed, and the data are now being prepared for the early issuance of a progress report.

While the nature of the initial study was exploratory, with the development of technique of primary concern, certain specific objectives were set up. These were to determine to what extent various physical and biotic factors influence the degree of utilization of Arizona fescue (Festuca arizonica).

This study was made on the Government Mountain grazing allotment, an area of approximately 17,000 acres which is located on the Spring Valley Ranger District of the Kaibab National Forest in northern Arizona and is grazed during summer by cattle. Methods

employed involved the measurement of all plant cover and of the stubble height for all grasses on randomly located line transects 1/ and the recording of data regarding site factors at each sample plot (line transect) on an especially designed form. The data were transferred from field sheets to 5x8-inch cards from which all subsequent computations were made. The data were then treated statistically by means of regression analysis for all factors upon which grazing use was thought to be dependent, such as percent of slope, distance from water, distance from fence, species composition, etc. Present indications are that other factors such as exposure, soil texture, range condition, etc. can best be treated simply by comparing the means of the degree of grazing use obtained at different levels under each of these factors.

Major findings from the preliminary analyses are:

1. For the allotment as a whole Arizona fescue constitutes 19.4 percent of the total measured herbaceous vegetal cover of 13.7 percent 2/ and mountain muhlenbergia (Muhlenbergia montana) constitutes 57.3 percent or approximately three times that of the fescue.

2. Mean degree of grazing use at the end of the grazing season as calculated on a volume basis from data obtained on the randomly located sample plots was 8.9 percent for Arizona fescue and 26.9 percent for mountain muhlenbergia.

3. Distance from water, percent of slope, distance from fence, distance from road or trail, and amount of mountain muhlenbergia all exert a measurable influence on the degree of grazing use of Arizona fescue, as determined by simple linear regression analysis (table 1).

The downward trends in grazing use due to the effects of the factors itemized in column 1 are indicated by the figures in column 2. In the field the slope factor appeared to be one of primary importance in controlling cattle movement. On this allotment slopes above 40 percent were not ordinarily grazed, indicating that such areas should not be regarded as available to cattle. Amount of travel up a slope of any given angle also appeared important, although as shown under "Distance from bottom of slope" the calculated regression coefficient for this factor was not significant.

1/ Canfield, R. H. "Application of the line interception method in sampling range vegetation" Jour. For. 39:388-394, 1941.

2/ Area occupied to the exclusion of any other plant measured at ground level.

Table 1.—Effects of certain physical and biotic factors on degree of grazing use of Arizona fescue

Factors affecting degree of use	Decrease in degree[1] of use due to factor in column 1 (b)	Level of significance[2] (b)
	Percent	Percent
Distance from water	.0423 per chain	1
Percent slope	.1791 per 1 percent	1
Distance from bottom of slope	.1174 per chain	Not significant
Distance from fence	.0416 per chain	2
Distance from road or trail..	.0788 per chain	5
Percent composition of mountain muhlenbergia	.1012 per 1 percent	2

1/ Determined by use of the equation $Y = a+bx$

2/ Determined by comparison of T values obtained by use of the equation $T = \frac{b}{Sb}$ where b = regression coefficient and Sb = standard error, with probabilities given in Fisher's table of T.

Distance from water showed a small but highly significant effect on grazing use. It is believed that this factor would have exerted a greater influence had it not been for the relatively light use of the forage on the allotment as a whole that allowed the cattle to fill up on feed within a short distance of water.

Distance from fence was obviously of considerable importance particularly at distances within 20 chains. Cattle trails invariably parallel each fence, and this fact coupled with the apparent natural tendency of cattle to "hang up" along fences is believed responsible for the increased grazing use in the vicinity of fences.

The effect of roads which serve as access routes as well as natural stock trails was also very obvious in the field. The concentration of grazing use along either side of a trail was probably relatively greater than would have been the case had grazing use for the allotment as a whole been heavier. With an abundance of palatable forage present the cattle exhibited a tendency to graze out laterally from the trails only the distance required to enjoy good grazing.

Based on measurements made at the close of the summer grazing season, Arizona fescue was definitely less palatable than mountain muhlenbergia, the most abundant grass on the allotment. The degree of grazing use on the fescue decreased significantly as the relative composition of muhlenbergia increased, indicating that, under the degree of grazing use which prevailed on the allotment during the past summer, use on Arizona fescue may have been incidental only.

Conclusions to date:

1. Paired measurements of plant intercept and stubble height on randomly located line transects appear to be a workable method for obtaining a measure of the degree of use on range allotments.

2. Concurrent measurement of degree of use and site factors on randomly located sample plots yields data which can be treated statistically by regression analysis to express the effect of any site factor which bears a linear relationship to grazing use.

COOPERATING BUREAU PROJECTS

ENTOMOLOGY

(In cooperation with the Bureau of Entomology and Plant Quarantine)

Appalachian

Termite Control. Additional tests have been initiated to determine the effectiveness of different types of 26-gage galvanized iron termite shields. Each recent test was set up in a cylindrical cage made of plastacele with a wooden pier embedded in a plaster of Paris base. The shield, supported by the pier, rests upon the top of the cage. Several thousand worker termites were isolated in the moist soil of each cage, which was subsequently stored in a cabinet providing high temperatures and humidity. Preliminary studies show that widespread shelter tube construction is obtained with a large termite colony population established in moist, warm soil in an atmosphere of high humidity. Of 9 cages in which many shelter tubes attained the edges of the shields, 8 failures occurred; that is, this many shelter tubes were constructed around and over the edges of the shields. Two of these failures concerned standard shields, one of the better types of shields commonly installed on buildings as a termite barrier, and a third failure a standard shield, modified in that the edges were rounded. The remainder of the failures involved a cage in which a flat sheet of 26-gage galvanized iron was tested. In the case of the standard shields (2-inch downward projecting 45° angles) tested, many shelter tubes terminated at the edges of the shields, whereas only a few surmounted the edges. However, these failures indicate that the metal barrier, even though properly installed on buildings, is not likely to be 100 percent effective and that all

shielding should be inspected periodically to determine whether or not termite shelter tubes have been constructed over it.

During May a number of National Defense Housing Projects under construction in South Carolina, North Carolina, and Tennessee, were inspected and recommendations for termite prevention and control in these buildings and others to be constructed in the future were offered to the various agencies concerned.

Wood Preservation. On the Santee Experimental Forest, one lot of healthy loblolly pines was treated with sodium pentachlorphenate dissolved in water, and another with pentachlorphenol dissolved in methyl alcohol. The intake of the chemicals by the trees was very poor, especially in those treated with sodium pentachlorphenate.

Northeastern

R. C. Brown and B. H. Wilford of the New Haven, Connecticut laboratory have visited defense housing projects of the U. S. Housing Authority and Public Building Administration, and U. S. Army cantonments, Naval and Air bases in New York and New England to confer with officials relative to construction and maintenance of buildings to prevent termite attack. In some instances an opportunity has been afforded to discuss construction details while the projects are in the blueprint stage and to make recommendations for proper construction to prevent termite attack. In other cases, notably Army cantonments, where construction has been completed, recommendations have been made concerning the maintenance of the buildings to minimize termite attacks. It is believed that these contacts have already resulted in considerable savings in initial construction expense and have also reduced maintenance costs appreciably.

White Pine Sprayed For Control of the White Pine Weevil, Pissodes strobi Peck. S. F. Potts, New Haven, Conn., reports that several hundred acres of white pine plantations were treated with concentrated spray for control of the white pine weevil in Connecticut and New York in cooperation with the Connecticut State Forester and New York Conservation Department. These areas were covered at the rate of about 3 acres per man-day using approximately 4 gallons of lead arsenate concentrate per acre at a total per acre cost of about $2.00.

For most of this work the equipment consisted of an ordinary knapsack sprayer or fire pump to which was attached a simple but special type of extension rod and a nozzle for finely atomizing the spray in the form of a narrow, solid-cone.

Conifers Sprayed For Control of the Pales Weevil. According to S. F. Potts good control of the pales weevil (Hylobius pales) was obtained by the application of concentrated spray to conifers in plantations, beds, and heeled-in bundles. The cost of treatment was about $1.50 per 1,000 trees in plantations and about 25 cents per 1,000 trees in beds and bundles.

Parasites for the LeConte Pine Sawfly Outbreaks in Plantations of the T. V. A. W. F. Sellers, New Haven, Conn., reports that during April this laboratory supplied from 300,000 to 400,000 Microplectron fuscipennis Zett., a gregarious chalcid parasite, for release in pine plantations of the Tennessee Valley Authority that have been severely infested by the native LeConte's sawfly in the vicinity of Wilson Dam, Alabama. This introduced parasite of the European spruce sawfly will attack practically all species of Diprion and Neodiprion sawflies. LeConte's sawfly cocoons are readily attached by M. fuscipennis under laboratory conditions. This shipment is intended for release in newly discovered infestations, but at the same time will supplement the 30 colonies supplied by the New Haven laboratory last November for release in the same general area.

Southern

Johnston, at Saucier, Miss., continued his tests of the relative effectiveness of metal termite shields. His conclusions are that soil moisture and humidity are important factors which influence tube building by termites; the smoothness of a surface hinders tube building, and the smoothness of the edge of a shield is the factor which largely determines the success or failure of a shield; where tubes branch and rebranch at the edge of a shield, an element of chance is involved as to whether a tube will extend back over the shield or not.

An examination of the nine nests of the Texas leaf-cutting ant on the Kisatchie National Forest, in which concentrated dosages of methyl bromide were placed in a few galleries each during the latter part of March, showed 100 percent control. Additional treatments will be installed during the summer to determine whether methyl bromide will be effective; no other fumigant has been successful during the summer.

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